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ABSTRACT

This document reports progress made by the Narangwal Rural Health Research Center in understanding the interactions of nutrition and infection in India. As part of a longitudinal study, 11 Punjab villages were divided into groups and received health care, nurtitional supplements or a combination of both. A control group received only symptomatic care. The health care program was aimed primarily at preschool children (0-3 years) and pregnant women. Prenatal and postnatal preventive programs, immunization, and on-the-spot curative care were provided. Two pilot projects stressing community participation were begun. Pilot project goals were to operate village feeding centers and to arrange for day care services during the harvesting season. Preliminary findings suggest that morbidity has been reduced in the groups of villages receiving combined care. However, data on the community participation projects is not yet complete. Longer periods of observation are needed before substantial conclusions can be drawn. Charts and tables comprise over half of the document. (WY)

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NARANGWAL RURAL HEALTH RESEARCH CENTRE

STUDY ON THE INTERACTIONS OF NUTRITION AND INFECTION

PROGRESS REPORT 1970-71

PS005169

STUDY ON THE INTERACTIONS OF NUTRITION AND INFECTION

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On June 1.1971 the Nutrition-Infection research project completed 5 years of total experience divided between more than 2 years preparatory work and almost 3 years of full field activity. This summary of the present status presents:

a) the original plans and hypotheses
b) the steps by which the project was built up
c) a review in detail of work done and results obtained during the past year
d) an outline of aims for the immediate future.

I. Original Plans and Hypotheses:

A. Study Objectives:

1) To study the effects of nutritional status on infection experience and the effects of infections on nutritional status.

2) To separate out experimentally the strength of causative variables in this interaction by providing various combinations of nutritional supplementation and preventive and curative health care.

3) To explore in detail the occurrence, relationships and implications of weight loss and growth retardation in children as result of various immunization procedures.

4) To study the patterns of child feeding in Punjab villages.

B. Subsidiary Objectives:

1) To develop methods and means of involving village communities in providing pre-school children with nutritional supplement.

2) To provide nutrition education to mothers through their active participation in R.H.R.C. feeding programmes.

C. Background:

The Narangwal Rural Health Research Centre has grown remarkably in the past ten years. We started research based in Narangwal because the Teaching Health Centre of Christian Medical College, Ludhiana, is located in this village. This project on the interactions of nutrition and infection started in 1966 with a grant from the World Health Organization to the Indian Council of Medical Research. Dr. Charlotte Neumann undertook the planning of the field work. It was decided to concentrate first on rather simple indices of nutritional status and infection experience. Comprehensive baseline surveys were started including cross-sectional anthropomteric measurements. Continuing survey methodology for morbidity and growth data were worked out and started on a pilot basis, service programs were initiated in one study village at a time for each service group so as to work out methods that were effective while still being practical for general application under Indian conditions. Dr. Cecile DeSweemer became project officer in the spring of 1968. The study was then expanded to the entire group of 11 villages.

Four cohorts of children were divided into groups receiving a) nutritional supplements alone; b) curative and preventive health care; c) a combination of nutritional supplements and curative and preventive health care; and d) control group receiving only symptomatic care. In each village a baseline period of observation of at least one year was carried out before the particular program was initiated. A Family Health Worker (FHW) who is trained as a lady health visitor with special orientation to prepare her specifically to gather research data, lives in each village. She not only collects research information but also provides the care appropriate for her group of villages. In September, 1970 Dr. DeSweemer returned to Baltimore and was replaced by Dr. A. Kielmann who has since taken over the field direction of the project.

D. Rationale:

Research on the interactions of nutrition and infection has the significant challenge that this disease complex probably represents the greatest cause of mortality and morbidity in the world today. Throughout the developing countries, by far the largest number of deaths occurs among children. Of these, a very large proportion are due to the synergism between malnutrition and common infections that would normally not cause serious illness. In addition, significant permanent damage to physical and mental development follows such synergistic disease. Where economic and educational developments are rapid, there is some spontaneous improvement in child health due to improved nutrition and better health care. Among the massive and densely crowded populations of developing countries it has become evident that a major block to economic development is the burden of ill health. In addition, increasing evidence suggests that critical problems associated with rapid population growth also impede development. Field studies in our Punjab villages and elsewhere are showing an increasing number of statistical associations which indicate that if child survival can be improved parents will be more ready to practise family planning.

It becomes increasingly apparent that control of the synergism between malnutrition and common infections can be achieved best by improving child care in the home. This requires development of local health services reaching right in to the village homes and working directly with mothers. This seems particularly true of the 0 to 3 yr. age group which is the period during which children are subjected to the greatest hazard from these synergistic effects.

There has been considerable speculation as to whether malnutrition was more important than infections or vice versa in causing synergistic interactions. The best approach to partialling out the strength of specific variables in the balance of interactions seems to be through providing reasonable services of specific types in situations where the interactions are well established. It is important that these service components be kept simple so that whatever practical measures are worked out have some possibility of eventually being widely implemented. New methods of supplying nutritional supplements under village conditions are greatly needed. It is also important to work out better ways of providing preventive services such as immunization. In addition, simple methods of providing medical care for acute childhood illnesses are particularly needed because of the evident demand of families and to establish rapport. All of these services must be simple enough to be provided by auxiliary workers. Built into all activities should be the constant effort to improve the mother's care of her children.

II. Recapitulation of Reports of Activities 1966-1970:

The tooling up and preparatory phase of this research project took more than two years. A major part of that time went into baseline surveys. Then there were longitudinal surveys covering morbidity measured weekly, anthropometry, fertility, vital statistics, and dietary surveys of children's feeding patterns. The 11 villages * were divided into four groups receiving the following patterns of care:

1. preventive and curative health care along (M.C.)
2. nutritional supplements alone (NUT)
3. Nutritional supplements and preventive and curative health care (MC-NUT)
4. Control.

These care services were gradually phased into the villages in each group between September 1968 and February 1970. Variation in timing was necessary because of field problems of arranging for village participation and the recruitment and training of the lady health visitors who live in the villages, collect data and provide services. In Appendix A these villages are listed

* One village, Rurka, received NUT supplement only was dropped from the study as of January,1971 because of "contamination" by the government health services, through the intensive work of a government auxiliary nurse midwife.

together with information on the sequence of introducing elements of the data collection system and service activities. (Tables I, II, III and IV)

III. Detailed Progress Report on Research Findings 1970-71

A. Introduction

In this report an effort will be made to refrain from repeating findings already presented in previous progress reports. The annual report for 1969-70 was submitted in July 1970 and includes a comprehensive review of the status of the project. The methodology of field work was described including specific procedures used in survey work. It also provided description of service methods which have been developed to provide nutritional and health care to children. The roles and responsibilities of the LHV, the Public Health Nurse, and the Physician were spelled out. Methods of quality control of field data were also given. These subjects will, therefore, not be repeated here.

B. Summary of Work Sequence

With all of the baseline surveys completed and full scale research and service activities underway, we have now started to analyze systematically available data and this process will continue to require increasing effort.

At the same time an effort is being made to "streamline" and improve our data collection and, fill "lacunae" in our service systems. 1) Preliminary findings suggest that morbidity has been reduced in the groups of villages receiving combined care. 2) There has been a significant increase in the rate of increment of both height and weight in the cohort receiving services. 3) The haemoglobin levels in the nutrition supplemented cohorts were found to be significantly higher than in the child care and control cohort. 4) The age of weaning has significantly increased over the two years period of observation.

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Before conclusions are drawn from these findings, however, we feel that it is absolutely essential to have considerably longer periods of observation. An incidental finding which is also still preliminary because of small numbers has been that DPT immunization produces a significant fall in weight of children, especially those who are not receiving nutritional supplementation. Measles vaccination had a less marked effect since it only produced a reduction in average expected weight gain when compared with other village children.

C. General Background Findings

Preliminary hand tabulations have been done of some data relating to general health status in these villages. Some representative data will be summarized here. The perinatal mortality was 70 per 1,000 live births. Infant mortality was 136 per 1,000 live births with neonatal deaths being 93 per 1,000 and deaths from 1 month to 1 year being 42 per 1,000. The 1-5 year death rate was 39 per 1,000 live births. A male/female differential is clear with the male infant mortality rate being 130 per 1,000 and the female rate 143 per 1,000. Death rates from 1-5 years were males = 27 per 1,000 and females = 55 per 1,000.

Preliminary results already available from the baseline surveys give a general picture of the social and economic situation in the villages being studied in the two projects at Narangwal. Coverage for the baseline survey has been more than 80% in all villages (Table I-1). The age and sex composition (Table I-2) shows a preponderance of male children (53.6%) and a child population (upto 15 years) of 28.8%. The caste distribution (Table I-3, Figure I-1) shows different age distributions among Jats and the schedule castes. Of the males 46.7% are illiterate and only 2.1% have had more than 10 years of schooling (Table I-4). Among females 65.2% are illiterate and only 6% have more than 10 years education (Table I-5).

TABLE I-1

Baseline Survey (1969)

Village	Number of Households	Interviewed for Census	Interviewed for Socio-Economic	Number of Eligible Women	Interview for Pregnancy History
Mansuran	360	359 (99.7)	330 (91.7)	355	338 (95.2)
Rattan	86	84 (97.6)	77 (89.5)	83	77 (92.7)
Kaind	98	94 (95.9)	91 (92.8)	90	84 (93.3)
Bool	92	92 (100.0)	92 (100.0)	81	77 (95.0)
Saya	301	275 (91.3)	275 (91.3)	251	235 (93.6)
Rurka *	244	214 (87.7)	214 (87.7)	209	191 (91.8)
Gurm	226	208 (92.0)	197 (86.7)	197	172 (87.3)
Tugal	164	154 (93.9)	146 (89.0)	163	148 (90.7)
Rattowal	263	216 (82.1)	211 (80.2)	187	163 (87.1)

* Dropped from Nutrition Project as of January 1, 1971.

ssg/-

TABLE I - 2

Table showing distribution of population by sex and age

(Child Care Villages)

Age in years	Males	Females	Total
0 - 4	695 (53.0)	617 (47.0)	1312
5 - 14	1500 (55.4)	1204 (44.5)	2704
15 - 19	582 (53.6)	502 (46.3)	1084
20 - 29	841 (51.2)	800 (48.7)	1641
30 - 39	599 (52.3)	545 (47.6)	1144
40 - 49	426 (53.4)	371 (46.5)	797
50 +	910 (54.2)	768 (45.7)	1678
Total	5553	4807	10360

TABLE I - 3

Distribution of Population by Age and Caste

Age	Jats	Non-Scheduled Non Jats	Scheduled Caste	Others	Total
0-4	613 11.5	141 11.5	465 14.8	93 12.9	1312
5-9	666 12.5	156 12.8	432 13.8	97 13.5	1351
10-14	668 12.6	156 12.8	435 13.8	84 13.1	1353
15-19	543 10.2	140 11.5	325 10.3	76 10.6	1084
20-24	470 8.8	139 11.4	278 8.9	50 6.9	937
25-29	365 6.9	72 5.9	224 7.1	43 6.0	704
30-34	345 6.5	58 4.7	185 5.9	47 6.5	635
35-39	279 5.2	53 4.3	144 4.6	33 4.6	509
40-44	237 4.5	46 3.7	125 4.0	31 4.3	439
45-49	191 3.6	44 3.6	98 3.1	25 3.5	358
50-54	244 4.6	50 4.1	133 4.2	29 4.0	456
55+	675 12.7	163 13.3	286 9.1	98 13.6	1222
Total	5296	1218	3130	716	10360

Figure I-1

Caste composition of 5 year age Groups
Reflecting differential fertility and mortality in all ages and
Differential mobility in 20-24 year olds

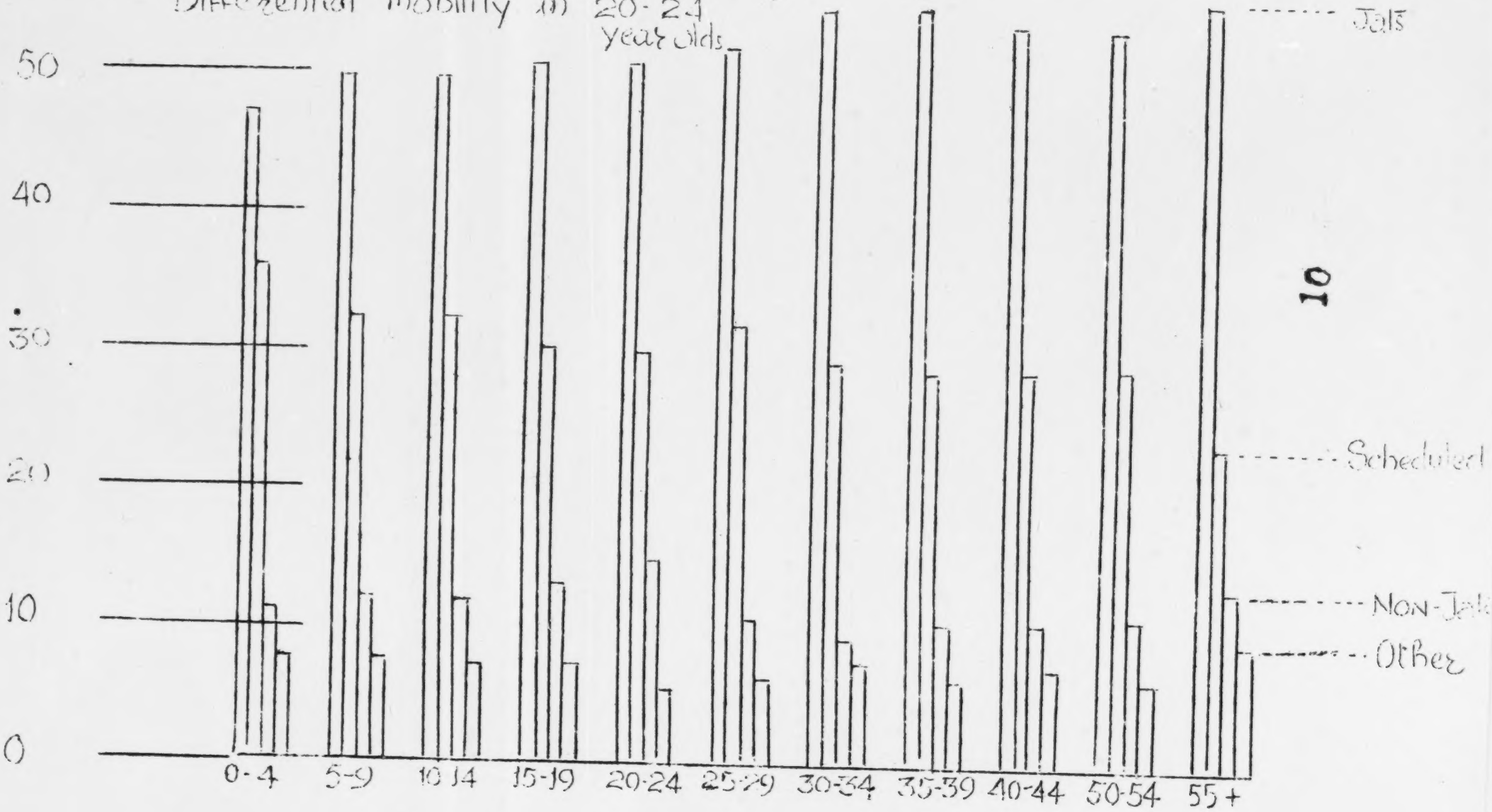


TABLE I - 4

Distribution of Males by their Literacy Status and Age

Age	Illiterate	Literate (can read & write but no school)	1-5 years of school	6-10 years of school	11-16 years of school	Total
5-9	391 52.3	24 3.2	332 44.4	0 0.0	1 0.1	748
10-14	128 16.9	2 0.3	426 56.3	201 26.5	0 0.0	757
15-19	170 29.2	1 0.1	95 16.3	306 52.6	10 1.7	582
20-24	174 37.6	3 0.6	69 14.9	185 40.0	32 6.9	463
25-29	184 48.7	11 2.9	26 6.9	129 34.1	28 7.4	378
30-54	739 59.4	137 11.0	113 9.1	225 18.1	31 2.5	1245
55+	487 70.6	108 15.6	41 5.9	50 7.2	4 0.5	690
Total	2273	286	1102	1096	106	4863

TABLE I - 5

Distribution of Females by their Literacy Status and Age

Age	Illiterate	Literate (can read & write but no school)	1-5 years of school	6-10 years of school	11-16 years of school	Total
5-9	350 58.0	13 2.2	239 39.6	1 0.2	0	603
10-14	160 26.6	0	305 50.7	136 22.6	0	601
15-19	195 38.8	4 0.8	150 29.9	147 29.3	6 1.2	502
20-24	248 52.3	14 2.9	128 27.0	70 14.8	14 2.9	474
25-29	234 71.8	14 4.3	60 18.4	15 4.6	3 0.9	326
30-54	1034 89.7	63 5.5	4 3.8	10 0.9	1 1	1152
55+	513 96.4	14 2.6	3 0.6	1 0.2	1 0.2	532
Total	2734	122	929	380	25	4190

TABLE I-6

Distribution of Population by Occupation and Caste

Caste	Students and retired people	Un-employed.	Agriculture and supervision of land	Casual Agricultural labour & tending cattle	Business, trade, artisans, health workers, etc.	Salaried workers teachers and other technical workers.	Others	Total
Jats	197	18	1260	79	26	86	110	1776
Row %	11.1	8.1	70.9	4.4	1.5	4.8	6.2	52.9
Non-scheduled non-Jat	52	6	12	97	132	56	44	399
Row %	13.0	1.5	3.0	24.3	33.1	14.0	11.0	11.9
Schedules Castes	92	12	61	539	124	92	49	960
Row %	9.6	0.1	6.3	55.2	12.9	9.6	5.1	28.5
Others	36	3	8	31	66	41	38	223
Row %	16.1	1.4	3.6	13.9	29.6	18.4	17.0	6.6
Total	377	39	1341	737	348	275	241	3358
Row %	11.2	1.2	39.2	21.9	10.4	8.2	7.2	

****

Education by age shows a definite improvement in younger age groups. Table I-6 showing caste versus occupation clearly indicates we are dealing with communities in transition. Though caste is still a strong determinant of occupation (70.9% of all Jats are agriculturists and conversely 94.0% of all agriculturists are Jats), each caste shows a wide variety of occupation.

Our primary research interest is in results relating to differences observed in groups of children receiving different patterns of care. When these preliminary analyses were done the periods of observation in the nutritional supplements alone and the preventive and curative care alone groups of children were not sufficiently long to give measurable results for all dependent variables. We did, however, have data on a period from December 1968 to November 1969 in which we could compare results between the combined care group of villages and the control children. The detailed data (Tables I-7, I-8, I-9) show a significant seasonal fluctuation with the control children failing to gain in the period from March to August, while they did most of their gaining from September to February. In both of these periods the children in the combined care group of villages showed better weight gain and even more clearly a better height increment. The morbidity information gathered on weekly visits by LHV's to each child's home continue to be somewhat hard to interpret, mainly because of continuing wide fluctuations. These fluctuations make it difficult to evaluate village differences. Shortly after the service program first started, clearly discernable differences developed in favour of the combined care group of villages. Over time, these have become somewhat less clear-cut. We feel that it is particularly important to continue the project for long enough to clearly define continuing patterns before final judgements are made. We are expecting to find our greatest differences in the duration of infectious morbidity, but these analyses have not yet been done. We also expect to analyze morbidity by diagnostic categories and to have information on complications.

An item of particular interest is the preliminary set of observations about how immunization causes weight loss in children. In a group of unselected village children 6-11 months of age, DPT immunization caused an average weight decline of over 1/10 kg in a one-week period. Children from a nutritional supplement village who were either demonstrably well nourished or receiving nutritional supplementation did not experience such weight loss. However, all groups of children 12-24 months of age experienced a somewhat less marked weight loss, regardless of whether they were on nutritional supplementation or not.

Similarly, in a study of the effect of measles vaccination, no consistent weight loss was found but the vaccinated group didnot gain as much as a comparison group of children, with the difference being statistically significant. In addition, 27% of vaccinated children showed weight loss during the two weeks of observation without evidence of other intercurrent infection.

D. Detailed Findings - Basic Research

In accordance with the basic research design, the effect of supplemental feeding plus medical care, feeding alone and medical care alone on morbidity experience and anthropometry continued to be measured throughout the past year. Similarly the effect of nutritional advice offered in nutrition supplement only and nutrition plus medical care villages, on children's diet and especially the weaning pattern continued to be measured by means of the dietary survey.

1) Longitudinal Survey Results

a. Anthropometric

Descriptive study of growth between 0-36 months. The mixed longitudinal study of growth covered the age group from birth to 36 months and measured length and weight as the most important anthropometric indices

TABLE I-7

Numbers of children going from one weight classification to another showing relative frequency of those increasing and decreasing in the Medical Care and Nutrition Group as compared with the Control Group.

	Med. Care cum Nutrition (221)		Control - n (175)	
	Increase	Decrease	Increase	Decrease
Dec 68-Feb 69	38	17	17	15 Not signif.diff
Mar - May 69	17	22	1	17 Sign. at 5%
June - Aug 69	20	18	4	34 sign. at 5%
Sept - Oct 69 and Nov 68	33	25	25	15 not sign.
Total	108	82	49	81 sign. at 5%

TABLE I-8

Children showing increase, decrease or the Expected Increment in height in Control villages

April and May, 1970

Age in months	Actual Increment + Increased	- Decreased	Expected Increment	Total
0 - 5	4	11	0	15
6-11	7	18	7	32
12-17) 18-23) 24-29)	15	30	4	49
30-35)	14	31	4	49
Total	40 *	90	15	145

* Significantly different from medical care cum nutrition.

TABLE I - 9

Children showing increase, decrease or the expected increment in height in Medical Care and Nutrition villages.

April and May 1970

Age in months	Actual Increment			
	Increased	Decreased	Expected Increment	Total
0 - 5	2	8	2	12
6 - 11	6	25	12	43
12-17) 18-23)	8	17	8	33
24-29) 30-35)	19	11	6	36
Total	35	61	28	124

(i) Length of Observation

The protocol for the growth study has the following guidelines:

1. At the outset (Sept. 1968) all children, birth to 36 months, were measured;

2. Subsequently all children resident in the village or planning to stay for 6 months or more were measured according to a routine schedule which was printed on special forms;

3. The routine schedule was as follows.

   Measure made:

   (a) monthly, of the child from birth to nine months;
   (b) every two months, from nine to twenty-one months;
   (c) every three months, from twenty-one to thirty-six months. This pattern was chosen to provide average increments which for the normally growing child would be over 250 g.

4. All measurements have been taken as nearly as possible on the day of the month on which the child was born plus or minus 5 days.

A complete longitudinal study is very difficult to make because of the mobility of our populations. More than ten percent of births take place in the home villages of the mothers. Also at any one point in time as many as twenty per cent of village women with their children are likely to have left the village for periods of several months duration, mainly to visit in their maternal homes.

Tables II-1 and II-2 show the distribution of age at first measurement (see right hand total column) for children taken into the study during their first year of life. More than 90% of children born to residents (approximately 540 during the period under consideration) were measured for the first time within the first three months of life. There was no difference in initial enrollment by sex or caste. Duration of observations seems independent of caste, sex and age at enrollment. (Tables II-3 and II-4).

Cross-sectional observations account for a very minor portion of the data. The data being analyzed reflect the observational period between September 1968 and June 1970. This cut-off data seems mainly to reflect the last observation date and no particular age seems to have a high drop-out rate. The modal number of months of observation was 17 months for males and 18 months for females. We have 17/520 males and 4/397 females exceeding the expected 21 months observation period. These children happened to have regular weight measurements taken during clinic visits before growth surveillance was started.

(ii) Mean Growth

Growth was analyzed according to age, caste and sex. Measurements used in the analysis are those taken according to the above routine schedule. A number of measurements taken on non-routine dates have been considered separately as they almost exclusively represented sick and malnourished children.

Table II-5 summarizes mean growth in weight by caste and sex. It shows that for all ages children of different castes achieved different heights and weights and that sexes within castes have different growth patterns. (Figure II-1).

Analyzing the growth by treatment groups also reveals significant differences. (Tables II-6 and II-7). The Palchowl group of villages (receiving comprehensive child care as part of our family planning study) is geographically located closest to two of our three MC-NUT treatment

Table II - 1

Number of children measured and their ages at the first and last measurements (Te

Age at first Measurement (Months)	Age at last Measurement (Months)																													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
0	0	5	8	5	4	4	5	2	4	3	3		5		2		8		6		1									
1				2	1	3	2	2	4	5	9		3	1	4		4	1	7	1	8	1								1	
2				2	3	6	5	5	2	4	4	2	5	1	2		1		4		4		5						1		
3					1	2		4	2	2	4		4		2		3		3		7		12	3							
4						2	1	1		1	7	1	3	1	3		4		1		1		3								
5							2	3		3		3		3		1							7			4			1		
6							1	1	3			1		1		2		2		3		4				3					
7								3				4				1		1				3				3					
8									1					1		1				1		1				1			1		
9										1			1	2		2		1		1		1				4			10	1	
10																										3			8		
11												1		1			1	2				1					1		2		1
12																		2											3		1
	5	8	9	9	17	13	17	19	12	32	3	29	4	21	0	27	3	29	1	26	1	37	4	0	18	1	0	26	2	2

miles)

30	31	32	33	Total
				65
				59
				56
				49
				29
				27
			1	23
			1	16
				7
1				26
				11
6				16
8			1	15
45	0	0	3	399

Table II - 2

Number of children measured and their ages at the first and last Measurements (

	Age at last Measurement																																
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
0	10	6	6	3	6	5	5	9	3	3	2	2		2		6	1	2	1														
1		2	1	3	2	6	5	4	4	4	2	4		2		3	5	1	9			3	1										
2			2	2	4		4	2	6	9	1	6	1	3	1	4	2	4		9		7			1			1					
3				3	2	2	3	10	2	10	1	6	1	1	1	1		3	1	7	1	11				1		1					1
4					1	1	1	1	4	4		4		1		3		4		2		9	1		1			3			1		
5						1	2		2		2	3		4		1		1		1	1	9	1		3								
6							1	1	4	3				1		2		2		3		2	1		5	1					1	1	
7								1	4	1		1		2		3		3	1			6		1	6			2					
8									1	1		4		1		2	1	1		1		5	1		4								
9										1	1		2	1		1		1				1			1		1	5	1				
10														1		2		2		1				2		1	1	10					1
11												1			1			3	1	2		1			2			6	1	4	1		
12													1	1								1			1			3	1	7	11		
Total	10	8	9	11	17	15	21	28	30	36	9	31	5	20	3	22	9	27	13	26	2	55	5	3	24	3	2	31	3	11	14	1	2

Males)

33	34	35	36	Total
				72
				61
				69
				69
				43
				31
			1	29
				31
1				23
1				17
				21
1				24
				26
3			1	516

TABLE II - 4

SUMMARY OF DURATION OF MEASUREMENT OF MALE CHILDREN BIRTH TO 36 MONTHS OF AGE.

Duration of Measurement [1]	Number of Children
25 months	4
24	3
23	3
22	4
21	1
20	6
19	13
18	38
17	58
16	32
15	26
14	16
13	22
12	7
11	13
10	13
9	18
8	25
7	33
6	34
5	32
4	32
3	22
2	21
1	21
1st Measure Only	27

[1] Duration of measurement equals age at last measurement minus age at first measurement.

TABLE II - 3

SUMMARY OF DURATION OF MEASUREMENT OF FEMALE CHILDREN BIRTH TO 36 MONTHS OF AGE.

Duration of measurement [1]	Number of children
19 months	22
18	42
17	26
16	25
15	25
14	14
13	8
12	8
11	15
10	10
9	13
8	23
7	19
6	22
5	23
4	23
3	17
2	20
1	19
1st Measure only	16

1 Duration of measurement equals age at last measurement minus age at first measurement.

Table II - 5

Average weight for age by caste and sex

(September 1968 - June 1970)

Caste	Jat				Ramdasia			
Age / Sex	Male		Female		Male		Female	
	n	$\bar{x}$ kg	n	$\bar{x}$ kg	n	$\bar{x}$ kg	n	$\bar{x}$ kg
0	29	3.04	21	3.02	26	2.80	32	2.82
1	51	3.86	41	3.63	32	3.81	49	3.51
2	65	4.74	56	4.41	65	4.49	70	4.04
3	95	5.50	74	5.05	75	5.06	82	4.74
4	100	6.32	80	5.54	77	5.69	80	5.17
5	107	6.69	87	5.84	88	6.17	83	5.57
6	109	7.01	86	6.20	95	6.54	79	5.85
7	109	7.29	75	6.46	87	6.54	74	6.09
8	110	7.56	68	6.69	92	6.79	78	6.25
9	104	7.74	77	6.90	94	7.05	78	6.25
10	83	8.21	70	7.42	86	7.38	70	6.67
13	87	8.57	63	7.70	86	7.83	78	6.90
15	104	8.87	70	7.96	90	8.09	73	7.20
17	86	9.25	64	8.34	83	8.56	71	7.68
19	85	9.50	65	8.68	82	8.57	60	7.73
21	89	9.73	56	9.10	76	8.78	60	8.06
24	70	10.23	52	9.55	63	9.39	50	8.31
27	71	10.66	44	10.13	45	9.72	47	9.12
30	43	11.01	41	10.50	33	10.04	38	9.82
33	23	11.57	24	10.97	25	10.75	22	10.58
36	11	12.24	13	11.57	13	11.08	6	10.65

Others			
Male		Female	
n	$\bar{x}$ kg	n	$\bar{x}$ kg
16	3.12	10	2.39
22	4.29	19	3.31
27	4.61	25	3.95
38	5.42	30	4.37
44	6.10	33	5.01
40	6.46	35	5.57
40	6.94	41	6.07
45	7.17	47	6.37
38	7.41	47	6.44
34	7.68	45	6.60
39	7.92	40	6.76
37	8.62	38	7.10
48	8.85	47	7.45
44	9.08	37	7.94
40	9.16	35	8.29
34	9.39	36	8.50
43	9.83	29	9.25
33	10.62	24	9.31
27	11.20	20	9.98
15	11.37	16	10.41
8	11.24	5	11.56

Table II - 6

Average weight for age by sex and cohort (Ramdasia)

(September 1968 - June 1970)

Age	RAMDASIA MALES								RAMDASIA FEMALES							
	MC -- NUT*		Pakh.[x]		Med. C.		Control[o]		MC -- NUT		Pakh.		Med. C.		Control	
	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg
0	13	2.97	9	2.59	4	2.75	0	--	10	2.70	11	3.00	10	2.77	1	2.4
1	15	3.81	10	3.88	5	3.62	2	3.90	14	3.31	24	3.49	7	3.31	4	3.47
2	24	4.46	29	4.40	6	4.42	6	5.12	20	3.95	26	4.10	14	4.00	10	4.13
3	26	5.26	34	4.96	11	4.91	4	5.07	29	4.81	29	4.74	14	4.58	10	4.76
4	24	5.91	32	5.42	12	5.29	9	5.73	29	5.26	29	5.08	12	4.96	10	5.43
5	30	6.43	34	6.01	13	5.84	11	6.36	27	5.76	31	5.41	12	5.29	13	5.84
6	26	6.58	43	6.33	12	6.16	14	6.78	26	6.02	32	5.82	9	4.93	12	6.26
7	23	6.61	38	6.60	13	6.34	13	6.44	24	6.17	27	5.97	10	5.79	13	6.40
8	22	6.93	40	6.70	14	6.65	16	6.94	26	6.42	28	5.96	11	6.13	13	6.62
9	24	6.99	42	7.07	13	6.74	15	7.33	29	6.26	25	5.92	11	6.32	13	6.78
11	19	7.58	39	7.20	14	7.32	14	7.66	25	6.55	23	6.40	8	6.54	14	6.89
13	24	7.91	33	7.85	14	7.74	15	7.66	29	6.90	25	6.73	10	6.73	14	7.33
15	25	8.23	33	7.96	18	8.26	14	7.96	26	7.15	25	7.07	7	7.84	15	7.19
17	22	8.74	34	8.42	13	8.46	14	8.11	27	7.74	21	7.36	10	7.69	13	7.52
19	24	8.83	33	8.34	16	8.89	9	8.16	21	7.76	21	7.79	9	7.47	9	7.78
21	23	9.36	30	8.42	14	8.91	9	8.32	21	8.02	20	8.13	9	7.99	10	8.04
24	18	9.84	22	8.94	12	9.38	11	9.55	18	8.48	18	8.18	8	8.06	6	8.52
27	15	10.05	13	9.75	12	9.68	5	8.72	21	9.20	13	9.20	11	9.00	2	8.40
30	11	10.77	11	9.89	10	9.54	1	8.50	18	9.80	12	9.87	8	9.80	0	--
33	11	11.14	7	10.30	7	10.60	0	--	9	10.37	9	10.72	4	10.72	0	--
36	5	11.38	1	10.50	5	10.72	2	11.50	3	10.20	1	12.50	2	10.40	0	--

* Feeding program and medical care by LHV's during the whole observation period.

[x] Feeding program and medical care by ANM's, medical care for the two year observation, feeding only during 2 y. in one village, 1-1/2 y. in second village, and 4th village to be started.

[o] In intensive area of government health center.

Table II - 7

Average Weight for Age by Sex and Cohort (Jats)

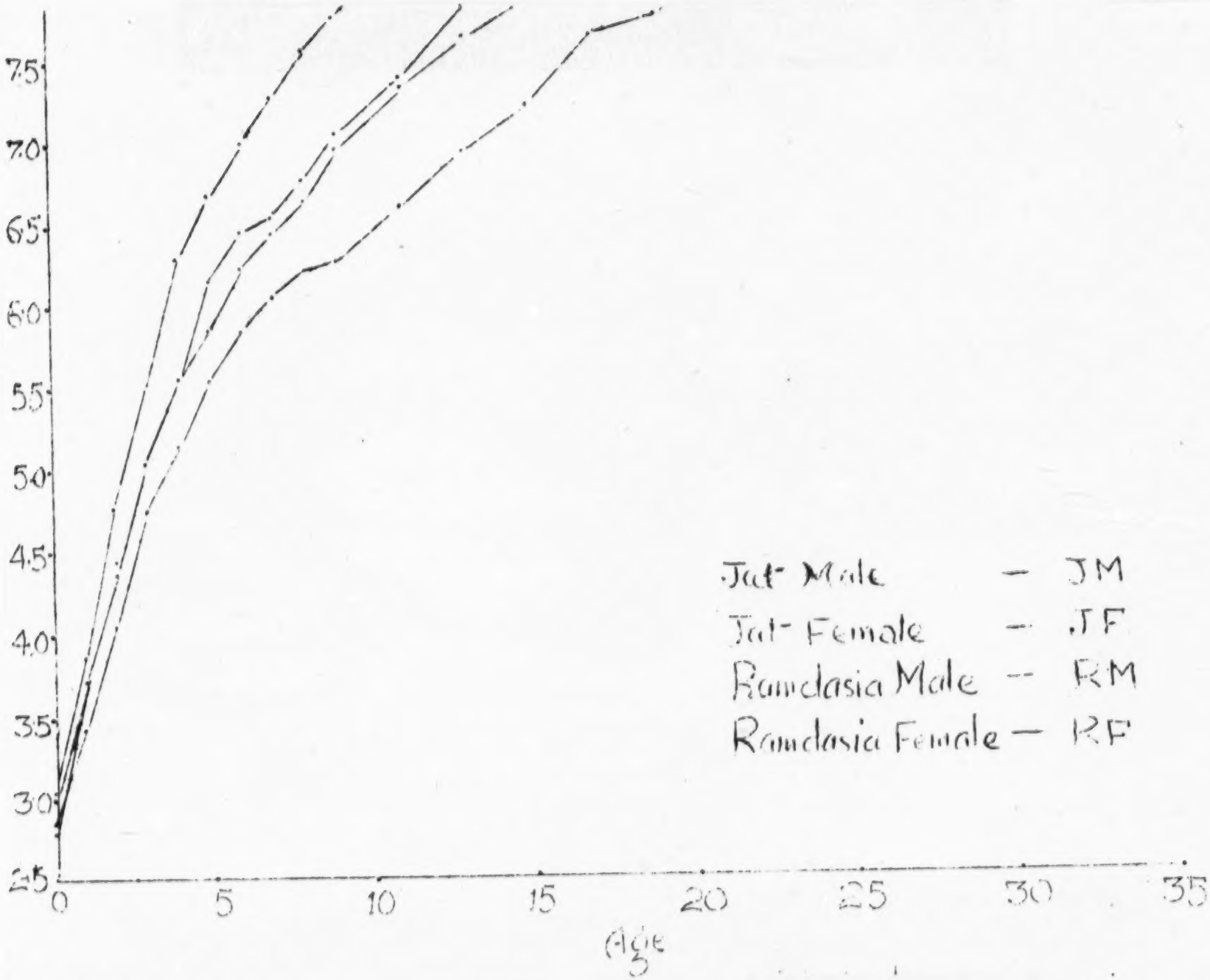
(September 1968 - June 1970)

Age (months)	JAT MALES								JAT FEMALES							
	MC --- NUT		Pakh.		Med. C.		Control		MC --- NUT		Pakh.		Med. C		Control	
	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg	n	$\bar{x}$kg
0	11	3.12	7	2.57	2	3.40	9	3.20	4	2.65	6	3.23	2	2.60	9	3.13
1	12	4.02	16	3.93	5	3.76	18	3.72	10	3.48	13	3.72	5	3.60	13	3.66
2	19	4.72	24	4.82	6	4.88	16	4.61	9	4.42	21	4.49	8	4.21	18	4.41
3	33	5.41	31	5.53	8	5.80	23	5.50	15	5.06	24	5.11	7	5.13	28	4.98
4	24	6.31	35	6.38	16	6.21	25	6.32	17	5.70	19	5.52	12	5.77	32	5.39
5	25	6.49	41	6.69	16	6.82	25	6.82	18	6.11	23	5.89	12	5.63	34	5.74
6	30	6.82	36	6.94	20	7.37	23	7.07	17	6.24	19	6.27	16	6.23	34	6.13
7	28	7.09	37	7.22	17	7.68	27	7.36	18	6.52	20	6.32	13	6.59	24	6.46
8	26	7.30	40	7.59	15	7.78	29	7.65	15	6.79	16	6.35	13	6.70	24	6.57
9	24	7.65	38	7.73	14	8.00	28	7.69	16	7.02	21	6.84	12	7.11	28	6.78
11	17	8.02	29	8.29	9	8.26	28	8.23	18	7.59	18	7.02	10	7.64	24	7.20
13	19	8.59	32	8.48	12	8.62	24	8.30	17	8.06	21	7.36	8	7.89	17	7.68
15	28	8.83	36	8.88	9	9.42	31	8.75	24	8.24	21	7.82	8	8.11	17	7.67
17	19	9.13	31	9.47	10	9.08	26	9.13	20	8.67	18	8.12	9	8.72	17	8.00
19	20	9.61	29	9.58	9	9.73	27	9.26	22	8.85	17	8.23	9	8.79	17	8.47
21	20	9.74	30	9.76	9	9.66	30	9.71	23	9.26	14	9.16	9	9.21	10	8.54
24	18	10.01	23	10.29	12	11.13	17	9.74	17	9.75	15	9.13	7	9.99	13	9.15
27	16	10.69	25	10.60	12	11.41	18	10.22	10	10.18	16	9.81	9	10.71	9	10.08
30	18	11.26	11	10.38	8	11.22	6	11.12	16	10.82	10	10.37	7	10.60	8	9.95
33	8	12.25	6	11.08	4	11.65	5	11.02	11	11.27	4	11.70	5	10.00	4	10.62
36	3	12.73	3	12.00	1	12.40	4	12.12	5	11.78	1	10.80	2	11.20	5	11.66

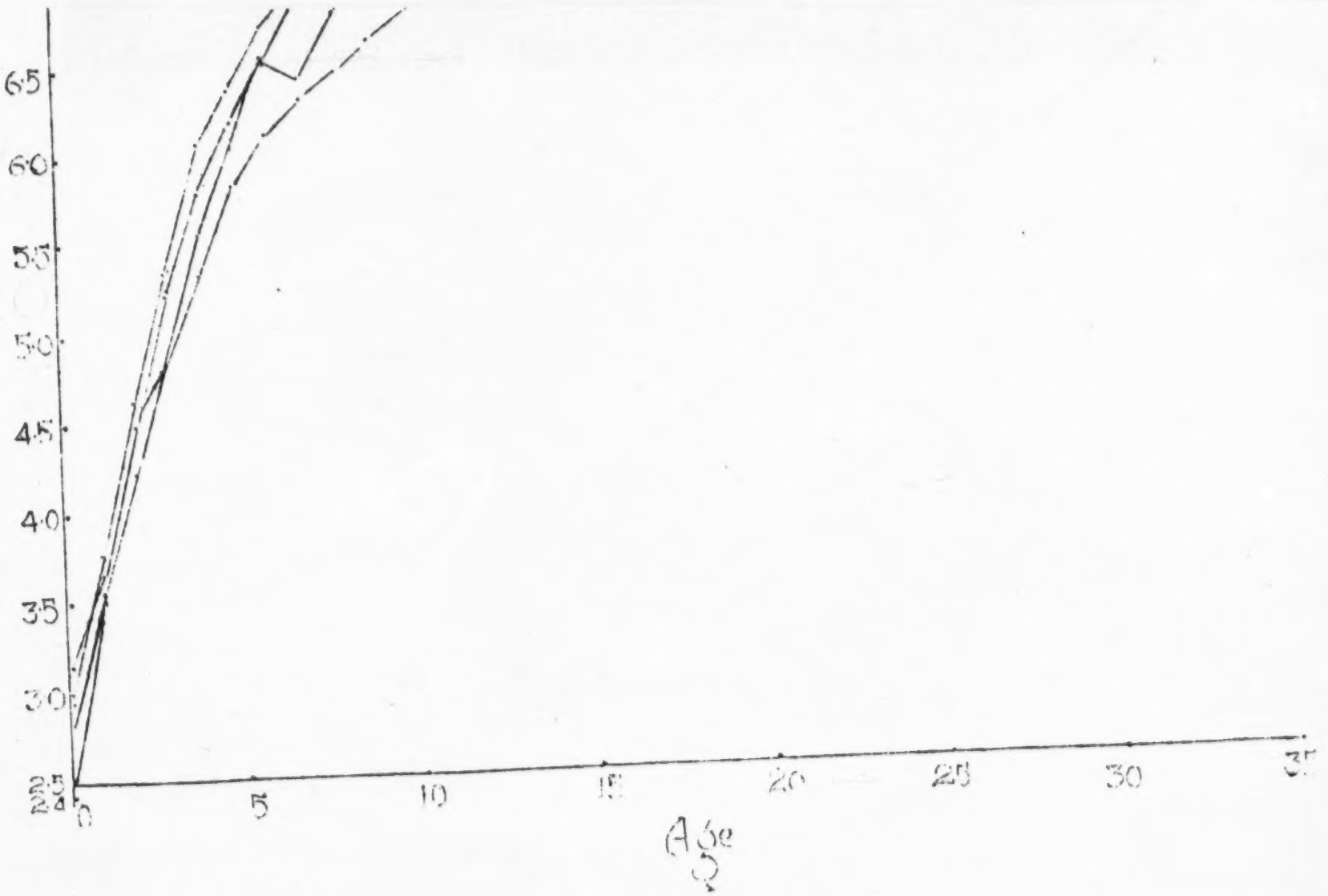
Between 12 - 21 Pakh & MC - NUT best
Between 21 - 36 Med. C. best & MC - NUT best
Control worse than Med C., predom. worse than Pakh.
Control better than MC - NUT first 12 m. than reverse.

Figure II 1

Average weight for age by sex and caste.


7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
0
5
10
15
20
25
30
35
Age
Jat Male — JM
Jat Female — JF
Ramdasia Male — RM
Ramdasia Female — RF

Average weight for age for "Treatment" and "control" groups by caste.


65
60
55
50
45
40
35
30
22.5
24
0
5
10
15
20
25
30
35
Age
Jat (Male + Female) Exp. Group - JE
Cont. Group - JC
Bandasia (Male + Female) Exp. Group - BE
Cont. Group - BC

villages and therefore probably shares certain village characteristics. In addition the service pattern in both groups includes comprehensive medical care and nutrition care for all children under 3 years. But services have been building up more slowly in the Pakhowal area because women's services and family planning are also provided. Moreover, the Family Health Workers in the Pakhowal area are former Auxiliary Nurse Midwives while those in the MC-NUT group are lady health visitors, who have more training. The scheme of home visiting is also more intensive in the MC-NUT group. Among the Ramdasia caste (Harijans and high risk) both males and females show a better weight growth in the MC-NUT group than in the Pakhowal group, and than in the medical care group. Weight increments of Ramdasia caste children in control villages bears no straight forward relation to weight increments of Ramdasia caste children of the other groups of villages. Ramdasia male children in the control villages were consistently below those in MC-NUT. But control Ramdasia female children were higher than the other group upto 12 months and subsequently very comparable to MC-NUT. We expect to undertake separate analysis of the different geographic units making up the control group (Rattowal/Tugal versus Kaind/Bool/Gurum to seek an explanation. In Jat children (land owning farmer caste) the influence of our services would be expected to be less pronounced since their need is less dramatic. Though they make frequent use of our medical services many also use private source of allopathic care. In addition nutrition care for them seldom requires actual supplementation but is more often limited to giving advice.

In Jats (both males and females) the control group at all ages have shown less weight gain than the medical care group, they were also somewhat worse off than the Pakhowal group. The control group Jat males were better off in the first twleve months of life than their counterparts in MC-NUT, and worse thereafter. MC-NUT Jat females gained more throughout than control Jat females. The irregular relationship of achieved weight gain in the control group compared with other groups, is probably related to village specific characteristics which will be analyzed. The fact that the control group of children after 1 year of age show slower and more irregular weight gain than other groups for both sexes and both caste groups would seem to indicate that our service programs overcame whatever handicap children in experimental groups may have started with (Figure II-2). In Figure II-1 data from all treatment villages (WS,-NUT,-CC; NUT-CC; NUT; CC) have been combined into the "treatment group". This was done to have a larger number of individual weights per given age group and to bring out differences between the control and treatment groups more clearly. Further analysis concentrating on increments rather than achieved growth should help clarify the influence of care programs as distinguished from the effects of village characteristics.

b) Vital Statistics

In our study villages vital events are collected from three sources:

a) the village chowkidar; who traditionally is responsible for collecting vital events in rural India,
b) our FHWs: these in turn get much of their information from local Dais,
c) Vital Statistics Investigators (VSI) who regularly visit every village once every two weeks to collect information from 12 key informants who have been selected because the nature of their occupation or status makes them particularly knowledgeable about village life. These key informatns thus include Nais, Teachers, indigenous medical practitioners, shopkeepers, panchayat members, Gram Sevikas and other influential community members.

With small populations in particular village groups a compilation of vital statistics by individual cohorts in individual years naturally shows great variation. For this reason we combined data from both the Nutrition and Population projects. As collection of vital events by FHWs was started only in March 1970, and since 4 of our control villages do not have a resident worker, a comparison of the three sources has not, at this stage

Table III - 1

Table comparing Vital Events independently record
and Chowkidars.
(Analysis from 23 experimental villages - from January 1969

		Births			Deaths		
		M	F	T	M	F	T
V.S.I	1969*	428	349	777	168	149	317
	1970	491	448	939	179	162	341
	Total	919	797	1716	347	311	658
Chowkidars	1969@	426 (99.5)	361 (103.4)	787 (101.3)	167 (99.4)	131 (87.9)	298 (94.0)
	1970	462 (94.1)	441 (98.4)	903 (96.2)	163 (91.1)	154 (95.1)	317 (93.0)
	Total	888 (96.6)	802 (100.6)	1690 (98.5)	330 (95.1)	285 (91.6)	615 (93.5)

* This does not include data from three experimental villages f
Chowkidars records are not available.

@ This does not include data from 2 villages for a period of tw
villages started in March 1969.

ed by Vital Statistical Investigators

to December 1970: figures in brackets are percentages)

Still births			Total		
M	F	T	M	F	T
12	23	35	608	521	1129
23	16	39	693	626	1319
35	39	74	1301	1147	2448
4 (33.3)	6 (30.0)	10 (31.3)	597 (98.2)	498 (96.1)	1095 (97.2)
8 (34.8)	5 (31.3)	13 (33.3)	633 (91.4)	600 (95.8)	1233 (93.5)
12 (34.3)	11 (30.6)	23 (32.4)	1230 (94.5)	1098 (96.0)	2328 (95.2)

or a period of six months since the data from

o months since the data collection in these

25

Table III - 2

Table showing vital events picked up jointly and individually by Vital Statistical Investigators and Chowkidars during 1969.

	Event	Event picked up by both VSIs and Chowkidars	% of total events	Extra Events picked up by VSIs	% of total events	Total events picked up by VSIs.	% of total events	Extra events picked up by Chowkidars	% of total events	Total events picked up by Chowkidars	% of total events	Total events
1969	Birth	711	88.3	66	8.2	777	96.5	28	3.5	739	91.8	805
	Death	274	79.4	43	12.5	317	91.9	28	8.1	302	87.5	345
	Still birth	11	32.4	21	61.8	32	94.1	02	5.9	13	38.2	34

Table showing vital events picked up jointly and individually by Vital Statistical Investigators and the Chowkidars during the first six months of 1970.

1970: Jan. - June.	Birth	353	83.8	42	10.0	395	93.8	26	6.2	379	90.0	421
	Death	150	72.1	42	20.2	192	92.3	16	7.7	166	79.8	208
	Still birth	-	-	12	92.3	12	92.3	1	7.7	1	7.7	13

Table III - 3

MORTALITY AND NATALITY RATES
(Local and Outgoing Events)

	1969			1970			
	Male	Female	Total	Male	Female	Total	Denominator
Perinatal death rate	45.9	48.1	46.9	76.7	61.7	70.0	1000 live births
Neo-natal death rate	75.7	65.3	71.1	87.3	100.6	93.3	"
Infant-mortality rate	110.8	151.2	128.6	129.6	142.9	135.6	"
Still-birth rate	34.4	64.3	46.2	40.6	37.5	39.2	1000 live & still births
Death rate 0 - 5	129.7	226.8	172.5	156.1	198.1	174.9	1000 live births
Death rate 1 - 5	18.9	75.6	43.9	26.5	55.2	39.4	"
Birth rate *			23			23	1000 population

* Excluding Jand and Ghuman

Table III - 4

MORTALITY AND NATALITY RATES
(Local and In-coming Events)

	1969			1970			
	Male	Female	Total	Male	Female	Total	Denominator
Perinatal death rate	42.3	40.4	41.5	67.2	55.8	61.8	1000 live births
Neo-natal death rate	71.3	62.0	67.1	77.4	91.5	84.1	"
Infant-Mortality rate	98.0	134.0	114.6	105.9	129.5	117.1	"
Still-birth rate	26.0	58.4	40.9	44.7	34.5	39.9	1000 live & still births
Death rate 0 - 5	122.5	199.5	157.3	126.2	167.4	145.9	1000 live births
Death rate 1 - 5	13.4	67.3	37.8	20.4	37.9	28.8	"
Birth rate *			29			32	1000 population

* Excluding Jand and Ghuman

A comparison of the two remaining sources - the chowkidar and the Vital Statistics Investigator shows that the chowkidar, over a two year period, missed only 4.8% of total births and 67.6% of still births reported by the specially trained V.S.I. (Table III-1). This presumably is related to the chowkidar's awareness that someone else was also collecting this data. In Table II-2, the V.S.I. and the chowkidar are compared for their ability to pick up vital events.

In Punjab, as well as in many parts of rural India, mothers usually go to their maternal home for delivery - especially for the first child. This creates particular problems in the collection of vital statistics for the study population who are recipients of our services. The parturients who leave for their maternal home, outside of our study villages are not recorded by the village chowkidars. On the other hand they do record the women from "outside" villages who deliver in our study villages.

Originally we assumed that ingoing andoutgoing events would cancel out each other i.e. the number of daughters coming into the village for delivery would over time approximate the number of daughters-in-law going to their maternal homes. This assumption has not been proved to be correct. At present we register about 4 times so many incoming as outgoing events. As yet we have found no explanation for this phenomenon. Table III-3 gives the vital rates for local and outgoing events in our study population. Table III-4 gives these rates for the local and incoming events. These rates are based on the returns of the Vital Statistics Investigators (V.S.I.). As can be seen, early child mortality rates calculated on the basis of local and outgoing events are on the whole considerably higher than when calculated by using local and incoming events because of the different size of the denominator (1000 live births). Mortality and natality rates appear to have increased from 1969 to 1970. This may be explained principally by a) the rather small population involved - 22,000 in total, b) improved reporting of vital events, c) perhaps an increase in incoming as compared with outgoing events because of the services we provide.

TABLE III-5

Birth, Death and Fertility Rates as per V.S.I., Chowkidar and V.S.I. and Chowkidar combined (Local plus Incoming Events, 1970)

Rate	V.S.I.	Chowk.	V.S.I. & CHOWK	Denominator
Crude Birth Rate	31.3	29.8	33.3	1000 population
Crude Death Rate	11.4	10.3	12.3	" "
Gen.Fertility Rate	145	138	154	1000 women 15-49
Nupt. Fert. Rate	229	218	243	" married women 15-49

Table V gives a comparison of the Crude Birth, Death and the General and Nuptial Fertility Rates for local and Incoming events for 1970 arrived at through the V.S.I., the Chowkidar and the V.S.I. plus chowkidar combined. The Rates obtained through the combined sources are probably closest to reality. As the village Chowkidar only registers local and incoming events no such comparison for local and outgoing events is possible at this stage.

E. Dietary Survey

1) Analysis of Age at Weaning:

The Dietary Survey was introduced in October 1969 in all villages receiving nutrition supplements.

Children from three cohorts (WS, NUT, CC), CC, NUT) and NUT were included in a monthly survey of food consumption. The age at which they were weaned has been analyzed upto May 1970. Weaning age is measured in months. Comparisons of weaning age were made for 1968, 1969 and 1970 to test whether the age at weaning has significantly changed over this period of time.

Because of small numbers all children in the three cohorts were pooled and similarly the children weaned during the years 1968 and 1969 were grouped. Tables IV-1,2 show the number of children by category and their age at weaning.

TABLE IV-1

Mean Age at Weaning in Months by Sex of Child

Sex	Mean Age 1968+1969	(N=141) N	Mean Age 1970	(N=180) N	Difference ('t')
Males	14.88	70	20.95	89	***
Females	15.53	71	19.90		***
Combined	15.21		20.42		***

*** Difference significant at the .001 level or beyond

TABLE IV-2

Mean Age at Weaning by Months by Caste of Child

Caste	Mean Age 1968+1969	(N=141) N	Mean Age 1970	(N=180) N	Difference ('t')
Sikh Jat	14.35	66	19.58	72	***
Ramdasia	16.45	49	21.67	74	***
Other castes	15.08	26	19.18	34	*
	15.21		20.42		***

*** Differences significant at the .001 level or beyond.
* Difference significant at the .05 level or beyond.

Inspection of Tables IV-1 and IV-2 reveals small differences in the age at weaning male versus female children, and between castes, with a slight but non-signiciant tendency for Ramdasias to wean later than others. A larger difference may be noted between the 1968 plus 1969 and the 1970 data reflecting uniformly increased age at weaning. A't' test performed on these data showed significance beyond the 5% level in all cases, and in most instances beyond the 0.1% level. The interpretation given to this difference is that there has been increasing awareness on the part of mothers in three of the village groups off the desirability of postponing weaning which has been reflected in their behaviour. It does not seem probable that they would so consistently report extended weaning just because they know we are interested, but this will be checked with more complete dietary surveys on samples. Our workers have systematically attempted to encourage delay in weaning, and we are inclined to believe that this increase may reflect some success in this direction.

In the coming year a cross sectional survey of all cohorts is also planned to explore whether the increased weaning age is a general trend in all villages, in this area, or whether it can be attributed to the nutritional advice in the three village groups for which data have been presented

TABLE IV - 4

PREPARATION OF SPECIAL FOOD FOR THE CHILD APRIL 1969 - JUNE 70
(AS REPORTED BY MOTHERS) ALL NUTRITION CARE VILLAGES

AGE	YES		NO		TOTAL
	n	%	n	%	
0 - 6 m	315	98	6	2	321
7 - 12 m	549	90	61	10	610
13 - 18 m	303	86	46	14	349
19 - 24 m	281	84	50	16	331
25 - 30 m	236	92	20	8	256
31 - 36 m	82	91	8	9	90
Age unknown	13	92	1	8	14
	1779	90	192	10	1971*

* 18 miscoded observations excluded

TABLE IV - 5

CONSUMPTION OF ADULT FOOD*

AGE	TOTAL	NO ADULT FOOD		ADULT FOOD					
				Each Meal		One Meal at least		Irregular Intake	
		n	%	n	%	n	%	n	%
0 - 6 m	318	316	99					2	1
7 -12 m	583	374	64	97	17	8	1	110	18
13 -18 m	319	49	15	170	53	14	5	86	27
19 -24 m	284	15	5	220	77	15	6	34	12
25 -30 m	224	4	2	211	94	1	-	8	4
31 -36 m	80	1	1	76	95	1	1	2	3
Unknown	13	6	31	6	31	-	-	1	38
	1819	765	42	778	42	39	3	237	13

Table IV - 3

Feeding pattern by age (Dhaipee, April 1969)

	BM only		BM + OF		OF only		Total
	No.	%	No.	%	No.	%	No.
0 - 6	10	71	4	29	-	-	14
7 - 12	8	40	12	60	-	-	20
13 - 18	-	-	13	100	-	-	13
19 - 24	-	-	7	41	10	59	17
21 - 30	-	-	3	21	11	79	14
31 - 36	-	-	2	13	14	87	16
All	18	19	41	44	35	37	94

45

Feeding pattern by age (Mansuran, Rattan, December 1968)

0 - 6	16	70	6	26	1	4	23
7 - 12	9	30	20	67	1	3	30
13 - 18	4	10	32	80	4	10	40
19 - 24	-	-	5	42	7	58	12
25 - 30	-	-	7	33	14	67	21
31 - 36	-	-	7	32	15	68	22
All	29	20	77	52	42	28	148

BM = Breast Milk

OF = Other food including milk products and adult type of food

Table IV - 6

ATTENDANCE OF FEEDING STATIONS REPORTED AT DIFFERENT AGE GROUPS

	0 - 6 m		7 - 12 m		13 - 18 m		19 - 24 m		25 - 30 m		31 - 36 m		Age Unknown	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Does not come	279	86.9	398	65.1	189	53.7	172	51.3	133	51.8	50	55.6	6	26.1
Morning	9	2.8	11	1.8	5	1.4	5	1.5	2	0.8	1	1.1	2	8.7
Evening	3	0.9	9	1.5	8	2.3	4	1.2	4	1.6	2	2.2	1	4.3
Morning & Evening	5	1.6	105	17.2	79	22.4	90	26.9	71	27.6	25	27.8	4	17.4
Irregular	7	2.2	37	6.1	35	9.9	30	9.0	31	12.1	9	10.0	1	12.3
No information	18	5.6	51	8.3	36	10.2	34	10.1	16	6.2	3	3.3	9	39.1
Total	321		611		352		335		257		90		23	

2) Weaning Pattern

We have used the dietary survey as one approach to monitor the compliance of mothers with our nutrition education. The information gained was purely qualitative, no attempt was made to get refined measurements of quantities of food taken by a child.

Table IV-3 shows the feeding pattern in three (Mansuran, Rattan and Dhaipee) of our nutrition supplement villages when we were about to start nutrition education. The "weaning" pattern in these three villages is more or less the same. Below 1 year of age less than 50% received supplementation. When the two halves of the year were compared it was found that about ¼ of children below 6 months of age received some form of supplementary food and over 60% received supplementation in the second half of their first year of life.

Analysis of "weaning pattern" by caste was done but did not show significant differences perhaps because of the relatively small sample size.

Tables IV-4 and IV-5 and summarise the dietary pattern in our service areas between January 1969 and June 1970. During this time special efforts were made to introduce mothers to special child foods (mainly suji and dalia). Table IV-4 shows that more than 80% of mothers reported they were preparing special child dishes for children under 3 years of age. This extraordinarily high percentage suggests over-reporting by mothers. At least it indicates that mothers were aware of our interest in increased supplementation.

Table IV-5 shows the consumption of adult food as reported by the mothers during the 18 months period (Jan 1969 to June 1970). As can be seen 36% of 7-12 years old get some adult food supplementation, half of them regularly with each meal. From 13-18 months, 85%; 2/3 of them regularly and from 19-24 months 95% and approximately 4/5th of them regularly get adult type food supplementation.

3) Feeding Centre Attendance

One of the questions in the dietary survey asks whether the child attends the feeding centre and if so, how regularly. We have analyzed the data collected to give an indication of the attendance at particular ages (Table IV-6). According to the dietary survey reports in the 7-12 age group slightly over 17% of children attend regularly with attendance reaching a plateau of 27% between 19-36 months. The whole program is based specifically on the feeding only those who need supplementation. The percentage coverage of the population aimed at has varied over time since at first we concentrated on the most severe malnutrition and moved slowly into feeding moderate malnutrition. This information may only be used as a rough measure of feeding centre attendance since it is based on the mother's recall. We are expecting to improve feeding centre attendace records for malnourished children (RHRC classification - see Appendix B) which should permit us to give more exact attendance figures in the future.

2) Cross Sectional Survey Results

A) -Cross-sectional Nutrition Survey (Clinical)

- To supplement the longitudinal data a nutritional assessment of children from birth to 60 months was carried out in a cross sectional survey devoted to detection of nutritionally significant symptoms. The 2046 children examined represent 93% of the estimated 2200 children of that age group resident in our villages. (Table V-1) The sex distribution closely approximates the distribution (53% males) in the general population.

Table V - 1

SEX DISTRIBUTION OF THE SURVEYED CHILD POPULATION BY COHORT

	WSCCNUT		NUT		CC		CCNUT		CONTROL		TOTAL	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	351	55.3	215	54.6	129	50.4	289	53.9	124	55.1	1108	54.2
Female	283	44.6	176	44.7	124	48.4	247	46.1	94	41.8	924	45.2
No Information	1	0.1	3	0.7	3	1.2	-	-	7	3.1	14	0.7
All	635	31.0	394	19.3	256	12.5	536	26.2	225	10.9	2046	100

Analysis by treatment groups will have to be done by stochastic processes. Preliminary cross-sectional analysis has only limited value but the most striking features are shown.

Table V-2 shows the overall clinical impression of nutritional status in each treatment area. The considerable variation is not readily explained and perhaps can best be attributed to village characteristics. The grouped averages for all areas with nutrition care is 80.9% "normal" children as compared with 75.5% in the areas without nutrition supplements (control and CC only cohorts).

Table V-2 through V-6 summarize some preliminary clinical findings. These judgements are obviously subjective and difficult to standardize.

Table V-3 summarizes the general impression of the child. The most frequent finding is pallor which ranged from 25 to 32% in the various groups without discernible relation to care programs. Pallor percentages do not approach the prevalence of over 60% demonstrable anemia. (See haemoglobin survey).

Table V-4 shows children with hair abnormalities reaching an overall figure of 42.8%. In addition 10% had two or more hair abnormalities. In the Punjab we see a great deal of yellowing of the hair under circumstances suggesting a specific nutritional deficiency. With better feeding black hair grows out. Therefore we have come to think in terms of discoloration of hair tips as a sign of an unknown deficiency which has been overcome. The fairly even distribution of this sign in all treatment groups indicates its general frequency but the whole hair discoloration shows no clear relation to the feeding programs. Sparse hair could also be an indicator of past problems but relationships are not completely clear.

Eye symptoms are summarized in Table V-5. Few specific nutritional eye signs were found. Conjunctivitis had a seasonally high frequency. Skin symptoms are summarized in Table V-6 and did not seem related to nutritional deficiencies except for some xerosis in the CC only villages.

No clear relationship between sex and specific symptoms was found except that females in general showed consistently greater under-nutrition than males (Table V-7). Analysis by caste showed no striking differences in hair, eye or skin symptoms but the overall clinical impression was that there was greater under-nutrition among Ramdasias in each treatment area, with overall figures of 14.6% Jats, 24.7% Ramdasias and 19.4% "Others". (Table V-8).

Analysis by age shows an increase in the frequency of pallor after the 8th month (Table V-9) and a decrease after the 22nd month. Hair signs are recognized from the 2nd month rising to 51% at 8 months of age. (Table V-10). Discoloration of hair tips lasts beyond the age of 5 perhaps because Sikhs do not cut their hair, and therefore continue to carry a visible "scar". The age distributions of a general clinical impression of under-nutritional (Table V-11) shows an overall prevalence of 5% between 2 and 60 months. Over 25% children are classified as suffering from nutritional deficiency between 9 and 24 months.

B) Cross-sectional Haemoglobin Survey (July-August 1970)

In July and August 1970 a cross-sectional haemoglobin survey was conducted in all villages of the Nutrition Project. Haemoglobin determinations according to the Sahli method were carried out on blood samples from 1180 children. Preliminary hand tabulations show that there is a marked degree of anaemia in our child population. Thus 68.5% of children had haemoglobin levels below 10 gm%. (Table VI-1) Children from 0-6 months of age had an average of 9.7 gm%. From 6-12, 12-18, 18-24 and 24-30 months of age the levels dropped to 9.0, 8.4, 8.8 and 8.5 gm % respectively. From 30-36 months the average again increased to 9.4 and above 36 months to 9.5 gm%. Average haemoglobin for all 1180 children came to 9.2.

Table V - 2

Clinical impression of Nut

Cohort	Total		No. Info.		Normal		Marasmus	
	No.	%	No.	%	No.	%	No.	%
WS NS CC	635	100	-	-	551	86.8	30	4.7
NUT	394	100	2	0.3	320	81.2	3	0.8
CC	256	100	-	-	184	71.9	3	1.2
NS CC	536	100	7	1.3	401	74.8	1	0.2
CONT.	225	100	-	-	178	79.1	5	2.2
All	2046	100	9	0.4	1634	79.9	42	2.1

19.9 % of all children examined show signs of malnutrition.

rition status by Cohort

Kwashiokor		Nut. Dwarfism		Under Nourish		Pre-Kwashiorkor		Abnormal	
No.	%	No.	%	No.	%	No.	%	No.	%
1	0.2	3	0.5	49	7.7	1	0.2	84	13.3
-	-	1	0.3	68	17.3	1	0.3	73	18.7
1	0.4	4	1.6	59	23.0	4	1.6	71	27.8
1	0.2	2	0.4	122	22.8	2	0.4	128	24.0
1	0.4	1	0.4	39	17.3	1	0.4	47	20.7
4	0.2	11	0.5	337	16.5	9	0.4	401	19.9

Table V - 3

Clinical symptoms of malnutrition by cohort (General impressions)

Cohort	All		No. Info.		Normal		Apathy		Pallor		Irritability		Apathy & Pallor	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
WS NS CC	635	100	1	0.2	407	54.1	10	1.6	206	32.4	11	1.7	0	0
NUT	394	100	1	0.3	285	72.3	2	0.5	104	26.4	2	0.5	0	0
CC	256	100	1	0.4	189	73.8	0	0	64	25.0	0	0	2	0.8
NS CC	536	100	5	0.9	341	63.6	7	1.3	175	32.6	8	1.5	0	0
CONT.	225	100	1	0.4	147	65.3	2	0.9	72	32.2	3	1.3	0	0
ALL	2046	100	9	0.4	1369	66.9	21	1.0	621	30.4	24	1.2	2	0.1

Table V - 4

Hair signs suggestive of Nutrition deficiency by cohort

Cohort	All		No. info.		Normal		Lustre lack		Sparseness		Dyspigmentation					
											Root		Tips		Whole hair	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
WS NS CC	635	100	-	-	391	61.6	16	2.5	32	5.0	1	0.2	158	24.9	34	5.4
NS	394	100	1	0.3	237	60.2	16	4.1	26	6.6	-	-	84	21.3	30	7.6
CC	256	100	2	0.8	124	48.4	28	10.9	18	7.0	-	-	66	25.8	18	7.0
NS CC	536	100	5	0.9	294	54.8	52	9.7	38	7.1	1	0.2	100	18.7	45	8.4
CONT.	225	100	1	0.4	115	51.1	8	3.6	23	10.2	1	0.4	52	23.1	25	11.1
ALL	2046	100	9	0.4	1161	56.7	120	5.9	137	6.7	3	0.1	460	27.5	152	7.4

Abnormal	
No.	%
227	35.8
108	27.6
66	25.5
189	35.3
75	33.3
665	32.7

Flag sign		Easy pluck-ability		Total (normal)	
No.	%	No.	%	No.	%
-	-	3	r.5	24[illegible]	[illegible]
-	-	-	-	156	[illegible]
-	-	-	-	134	[illegible]
1	r.2	-	-	[illegible]	[illegible]
-	-	-	-	169	45.5
1	r.1	3	0.1	[illegible]	[illegible]

Table V - 5

EYE FINDINGS

Cohort	All No.	%	No Info No.	%	Normal No.	%	Conjuct. xerosis No.	%	Bitot spots No.	%	Angular pulp No.	%
WS CC NS	635	100	-	-	544	85.7	1	0.2	18	2.8	1	0.2
NS	394	100	2	0.5	331	84.0	-	-	2	0.5	-	-
CC	256	100	2	0.8	224	87.5	1	0.4	3	1.2	-	-
NS CC	536	100	5	0.9	486	90.7	-	-	-	-	-	-
CONT.	225	100	-	-	196	87.1	-	-	2	0.9	1	0.4
ALL	2046	100	9	0.4	1781	87.0	2	0.1	25	1.2	2	0.1

Total abnormal eye signs : 256 (12.4 %)

Total abnormal eye signs of nut. significance : 29 (1.4 %)

Conjunctivitis Injection		Total abnormal		Total abnormal of N[illegible] significance	
No.	%	No.	%	No.	%
71	7.2	91	14.4	20	3.2
59	15.0	61	15.5	2	0.5
26	10.2	30	11.7	4	1.6
45	8.4	45	8.4	-	-
26	11.6	29	12.9	3	1.3
227	7.1	256	12.4	29	1.4

Table V - 6

Skin abnormalities by cohort

Cohort	Total		Normal		Follicular Hyperkeratosis. I		Follicular Dermatisis II		Mosaic Dermatisis		Xerosis		No Info.		Abnormal	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
WS CC NS	635	100	634	99.8	-	-	-	-	-	-	1	0.2	-	-	1	0.2
NS	394	100	394	100.0	-	-	-	-	-	-	-	-	-	-	-	-
CC	256	100	225	87.9	-	-	-	-	1	0.4	29	7.3	1	0.4	30	11.3
CCNS	536	100	534	99.6	1	0.2	1	0.2	-	-	-	-	-	-	2	0.4
CONT.	225	100	225	100.0	-	-	-	-	-	-	-	-	-	-	-	-
ALL	2046	100	2012	98.3	1	<0.1	1	<0.1	1	<0.1	30	1.5	1	<0.1	33	

Table V - 7

Clinical impression of Nutrition status by sex and cohort

	Sex	Total No.	Total %	No. Info. No.	No. Info. %	Normal No.	Normal %	Marasmus No.	Marasmus %	Kwashiorkor No.	Kwashiorkor %	Nut. Dwarfism No.	Nut. Dwarfism %
WS CC NUT	M	351	100	-	-	325	92.6	14	4.0	-	-	-	-
	F	283	"	-	-	226	79.9	16	5.7	1	0.4	3	1.1
	* No	1	"	-	-	-	-	-	-	-	-	-	-
	T	635	"	-	-	551	86.8	30	4.7	1	0.2	3	0.5
NUT	M	215	100	1	0.5	186	86.5	1	0.5	-	-	-	-
	F	176	"	-	-	131	74.4	2	1.1	-	-	1	0.6
	No	3	"	-	-	3	100.0	-	-	-	-	-	-
	T	394	"	1	0.3	320	81.2	3	0.8	-	-	1	0.3
CC	M	129	100	-	-	99	76.7	1	0.8	-	-	1	0.8
	F	124	"	-	-	83	66.9	2	1.6	1	0.8	3	2.4
	No	3	"	1	33.3	2	66.7	-	-	-	-	-	-
	T	256	"	1	0.4	184	71.9	3	1.2	1	0.4	4	1.6
CC NUT	M	289	100	3	1.0	226	78.2	1	0.3	1	0.3	-	-
	F	247	"	4	1.6	175	70.8	-	-	-	-	2	0.8
	No	-	-	-	-	-	-	-	-	-	-	-	-
	T	536	100	7	1.3	401	74.8	1	0.2	1	0.2	2	0.4
CONTROL	M	124	100	-	-	100	80.6	2	1.6	-	-	-	-
	F	94	"	-	-	72	76.6	3	3.2	1	1.1	1	1.1
	No	7	"	-	-	6	85.7	-	-	-	-	-	-
	T	225	"	-	-	178	79.1	5	2.2	1	0.4	1	0.4
TOTAL	M	1108	100	4	0.4	936	84.5	19	1.7	1	0.1	1	0.1
	F	924	"	4	0.4	687	74.4	23	2.5	3	0.3	10	1.1
	No	14	"	1	7.1	11	78.6	-	-	-	-	-	-
	T	2046	"	9	0.4	1634	79.9	42	2.1	4	0.2	11	0.5

* No = No information is available as to the sex of the child.

Under Nourish		Pre-Kwashiorkor		Total Abnormal	
No.	%	No.	%	No.	%
12	3.4	-	-	26	7.4
36	12.7	1	0.4	57	20.3
1	100.0	-	-	1	-
49	7.7	1	0.2	84	13.3
26	12.1	1	0.5	28	13.1
42	23.9	-	-	45	25.6
-	-	-	-	-	-
68	17.3	1	0.3	73	18.7
25	19.4	3	2.3	30	23.3
34	27.4	1	0.8	41	33.0
-	-	-	-	-	-
59	23.0	4	1.6	71	27.8
56	19.4	2	0.7	60	20.7
66	26.7	-	-	68	27.5
-	-	-	-	-	-
122	22.8	2	0.4	128	24.0
21	16.9	1	0.8	24	19.3
17	18.1	-	-	22	23.5
1	14.3	-	-	1	
39	17.3	1	0.4	47	20.7
140	12.6	7	0.6	168	15.1
195	21.1	2	0.2	233	25.2
2	-	-	-	2	-
337	14.3	9	0.4	401	19.9

Table V - 8

Clinical impression of Nutrition status by caste and cohort.

	Caste	Total No.	%	No info. No.	%	Normal No.	%	Marasmus No.	%	Kwashiorkor No.	%	Nut. Dwarfism No.	%
WS CC NUT	J	251	100	-	-	231	92.0	5	2.0	-	-	-	-
	R	257	"	-	-	213	82.9	22	8.6	1	0.4	1	0.4
	O	93	"	-	-	75	80.6	2	2.2	-	-	2	2.2
	N.I	34	"	-	-	32	94.1	1	2.9	-	-	-	-
	T	635	"	-	-	551	86.8	30	4.7	1	0.2	3	0.5
NUT	J	194	100	1	0.5	167	86.1	1	0.5	-	-	-	-
	R	80	"	-	-	60	75.0	-	-	-	-	-	-
	O	89	"	-	-	70	78.7	1	1.1	-	-	1	1.1
	N.I	31	"	-	-	23	74.2	1	3.2	-	-	-	-
	T	394	"	1	0.3	320	81.2	3	0.8	-	-	1	0.3
CC	J	134	100	-	-	102	76.1	-	-	-	-	1	0.7
	R	47	"	-	-	28	59.6	1	2.1	-	-	3	6.4
	O	56	"	-	-	42	75.0	2	3.6	-	-	-	-
	N.I	19	"	1	5.3	12	63.2	-	-	1	5.3	-	-
	T	256	"	1	0.4	184	71.9	3	1.2	1	0.4	4	1.6
CC NUT	J	186	100	1	0.5	148	79.6	-	-	-	-	-	-
	R	255	"	2	0.8	180	70.6	-	-	1	0.4	2	0.8
	O	91	"	4	4.4	69	75.8	1	1.1	-	-	-	-
	N.I	4	"	-	-	4	100.0	-	-	-	-	-	-
	T	536	"	7	1.3	401	74.8	1	0.2	1	0.2	2	0.4
CONTROL	J	46	100	-	-	41	89.1	1	2.2	-	-	-	-
	R	22	"	-	-	14	63.6	2	9.1	-	-	-	-
	O	38	"	-	-	35	92.1	1	2.6	1	2.6	-	-
	N.I	119	"	-	-	88	73.9	1	0.8	-	-	1	0.8
	T	225	"	-	-	178	79.1	5	2.2	1	0.4	1	0.4
TOTAL	J	811	100	2	0.2	689	84.9	7	0.8	-	-	1	0.1
	R	661	"	2	0.3	495	74.9	25	3.7	2	0.3	6	0.9
	O	367	"	4	1.0	291	79.2	7	1.9	1	0.2	3	0.8
	N.I	207	"	1	0.4	159	76.8	3	1.4	1	0.4	1	0.4
	T	2046	"	9	0.4	1634	79.9	42	2.1	4	0.2	11	0.5

J = Jats R = Ramdasia O = Others N.I = No information T

Under Nourish		Pre-Kwashiorkor		Total Abnormal	
No.	%	No.	%	No.	%
14	5.6	1	0.4	20	8.0
20	7.8	-	-	44	17.2
14	15.1	-	-	18	19.5
1	2.9	-	-	2	-
49	7.7	1	0.2	84	13.3
24	12.4	1	0.5	26	13.4
20	25.0	-	-	20	25.0
17	19.1	-	-	19	21.3
7	22.6	-	-	8	-
68	17.3	1	0.3	73	18.7
29	21.6	2	1.5	32	23.8
13	27.7	2	4.3	19	40.5
12	21.4	-	-	14	25.0
5	26.3	-	-	6	-
59	23.0	4	1.6	71	29.8
36	19.4	1	0.5	37	19.9
70	27.4	-	-	73	28.6
16	17.6	1	1.1	18	19.8
-	-	-	-	-	-
122	22.8	2	0.4	128	24.0
4	8.7	-	-	5	10.9
6	27.3	-	-	8	36.4
1	2.6	-	-	3	7.8
28	23.5	1	0.8	31	-
39	17.3	1	0.4	47	20.7
107	13.1	5	0.6	120	14.6
129	19.5	2	0.3	154	24.7
60	16.3	1	0.2	72	19.4
41	19.8	1	0.4	47	-
337	16.5	9	0.4	403	19.7

= Total

43

Table V - 9

Clinical Symptoms of Malnutrition by Age

Age	NORMAL n	NORMAL %	APATHY n	APATHY %	PALLOR n	PALLOR %	IRRITAB. n	IRRITAB. %	APATHY & PALLOR n	APATHY & PALLOR %	NO INFOR.	TOTAL	TOTAL ABNORMAL n	TOTAL ABNORMAL %
0 - 1.4 m	23	100	-	-	-	-	-	-	-	-	-	23	-	-
1.5 - 2.4 m	22	71	-	-	8	26	-	-	-	-	1	31	9	29
2.5 - 3.4 m	35	92	-	-	3	8	-	-	-	-	-	38	3	8
3.5 - 4.4 m	24	89	-	-	3	11	-	-	-	-	-	27	3	11
4.5 - 5.4 m	14	93	-	-	1	7	-	-	-	-	-	15	1	7
5.5 - 6.4 m	19	86	-	-	3	14	-	-	-	-	-	22	3	14
6.5 - 7.4 m	25	89	-	-	2	7	-	-	-	-	1	28	3	11
7.5 - 8.4 m	34	62	1	2	19	35	1	2	-	-	-	55	21	38
8.5 - 9.4 m	21	49	2	5	19	44	1	3	-	-	-	43	22	51
9.5 - 9.9	14	61	1	4	8	35	-	-	-	-	-	23	9	39
10.0 - 11.9	48	58	3	4	31	37	1	1	-	-	-	83	35	42
12.0 - 13.9	40	60	2	3	24	36	1	2	-	-	-	67	27	40
14.0 - 15.9	23	46	-	-	26	52	1	2	-	-	-	50	27	54
16.0 - 17.9	30	50	-	-	24	40	5	8	-	-	1	60	30	50
18.0 - 19.9	38	53	-	-	31	44	1	1	1	1	-	71	33	46
20.0 - 21.9	36	50	1	1	34	47	-	-	-	-	1	72	36	50
22.0 - 22.4	4	56	1	9	5	46	1	9	-	-	-	11	7	64
22.5 - 25.4	91	68	2	2	39	29	1	1	-	-	-	133	42	31
25.5 - 37.4	257	65	1	-	132	34	5	1	1	-	1	398	141	35
37.5 - 40.4	250	73	4	1	80	23	3	1	-	-	1	340	90	26
40.5 - 60	196	67	3	1	87	29	2	1	-	-	1	292	96	32
Over 3 y.	32	62	-	-	19	37	-	-	-	-	1	51	19	37
Age Unkn.	90	80	-	-	21	19	-	-	-	-	1	113	23	20
All Ages	1369	678	21	10	621	308	24	12	2	-	9	2046	677	33

Table V - 10

Hair signs suggestive of Nut. deficiency by age.

AGE (months)	NORMAL		LACK OF LUSTRE		SPARSENESS		DISPIGMENTATION						FLAG SIGN		PLUCKABILITY		TOTAL No. OF INDIVIDUAL	TOTAL ABNORMAL	
							ROOTS		TIPS		WHOLE HAIR								
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		n	%
0 - 1.4	22	96	1	5	-	-	-	-	-	-	1	4	-	-	-	-	23	1	4
1.5 - 2.4	26	84	-	-	3	10	-	-	1	3	1	3	-	-	-	-	31	5	16
2.5 - 3.4	29	76	-	-	7	18	-	-	-	-	1	5	-	-	-	-	38	9	24
3.5 - 4.4	17	63	3	11	8	30	-	-	2	7	3	11	-	-	-	-	27	10	37
4.5 - 5.4	12	80	-	-	3	20	-	-	-	-	2	13	-	-	-	-	15	3	20
5.5 - 6.4	15	68	-	-	6	27	-	-	1	5	2	9	-	-	-	-	22	7	23
6.5 - 7.4	18	64	1	4	5	18	-	-	-	-	7	25	-	-	1	4	28	10	35
7.5 - 8.4	27	49	3	6	12	22	-	-	8	15	11	20	-	-	-	-	55	28	50
8.5 - 9.4	15	35	5	12	12	28	-	-	11	26	10	23	-	-	-	-	43	28	65
9.5 - 9.9	13	57	-	-	1	4	2	9	3	13	5	22	-	-	-	-	23	10	43
10.0 - 11.9	42	51	6	7	16	19	-	-	16	19	24	29	-	-	-	-	83	39	46
12.0 - 13.9	37	55	4	6	9	13	-	-	14	21	13	19	-	-	-	-	67	30	44
14.0 - 15.9	20	40	6	12	7	14	-	-	12	17	15	30	-	-	-	-	50	30	60
16.0 - 17.9	24	40	6	10	6	10	-	-	18	30	12	20	-	-	1	2	60	36	60
18.0 - 19.9	22	31	6	9	9	13	-	-	32	45	15	21	-	-	-	-	71	49	69
20.0 - 21.9	27	38	6	8	7	10	1	1	27	38	15	21	-	-	-	-	72	45	62
22.0 - 22.4	2	18	-	-	2	18	-	-	5	46	3	27	-	-	-	-	11	9	82
25.0 - 25.4	63	48	14	11	5	4	-	-	46	35	20	15	-	-	-	-	133	70	52
25.5 - 37.4	238	60	39	10	14	4	-	-	131	33	48	12	1	25	-	-	198	160	40
37.5 - 49.4	216	65	16	5	2	1	-	-	94	29	25	8	-	-	-	-	330	114	34
49.5 - 60	204	70	15	5	5	2	-	-	64	22	19	7	-	-	-	-	292	88	30
Over 5 y. age	36	71	-	-	1	2	-	-	12	24	2	4	-	-	-	-	51	15	29
Age Unknown	66	58	-	-	13	12	-	-	26	23	11	10	-	-	1	1	113	47	41
TOTAL	1161	57	131	6.4	156	7.7	3	.1	523	25.7	266	13.1	1	.0	3	.1	2036	875	42

Table V - 11

Clinical impression of nutrition status by age.

Age (months)	NORMAL		MARASMUS		KWASHIORKOR		NUT. DWARF.		UNDER NOUR.	
	n	%	n	%	n	%	n	%	n	%
0 - 1.4	21	91	-	-	-	-	-	-	1	4
1.5 - 2.4	23	74	1	3	-	-	-	-	6	19
2.5 - 3.4	35	92	-	-	-	-	-	-	3	8
3.5 - 4.4	23	85	1	4	-	-	-	-	3	11
4.5 - 5.4	14	93	-	-	-	-	-	-	1	7
5.5 - 6.4	17	77	1	5	1	5	-	-	3	14
6.5 - 7.4	24	85	-	-	-	-	-	-	3	11
7.5 - 8.4	44	80	1	2	-	-	1	2	9	16
8.5 - 9.4	31	72	2	5	-	-	-	-	10	23
9.5 - 9.9	15	65	1	4	-	-	-	-	7	30
10.0 - 11.9	56	68	4	5	-	-	-	-	23	28
12.0 - 13.9	44	66	3	4	-	-	2	3	18	27
14.0 - 15.9	32	64	-	-	-	-	-	-	18	36
16.0 - 17.9	33	55	4	7	-	-	-	-	21	35
18.0 - 19.9	29	41	6	8	-	-	3	4	31	44
20.0 - 21.9	45	62	3	4	-	-	-	-	23	32
22.0 - 22.4	6	55	-	-	-	-	-	-	5	45
22.5 - 25.4	89	67	3	2	-	-	1	-	37	29
25.5 - 37.4	326	81	4	1	2	<1	2	<1	63	15
37.5 - 49.4	309	90	3	.7	1	<1	-	-	25	7
49.5 - 60	269	93	3	1	-	-	-	-	17	5
Over 5 years	49	96	1	.7	-	-	-	-	1	.5
Age Unknown	100	89	1	.8	-	-	2	2	9	.8
TOTAL	1634	80	42	2.1 %	4	.2 %	11	.5 %	337	16

* 8 individuals with unknown clinical classifications.

PRE-KWASHIORKOR		TOTAL CHILDREN	TOTAL ABNORMAL	
n	%		n	%
1	4	23	2	9
1	3	31	8	26
-	-	38	3	8
-	-	27	4	15
-	-	15	1	7
-	-	22	5	23
-	-	27	3	11
-	-	55	11	20
-	-	43	12	28
-	-	23	8	35
-	-	83	27	33
-	-	67	23	34
-	-	50	18	36
1	2	60	27	45
1	1	71	42	59
-	-	72	27	38
-	-	11	5	45
3	2	133	44	33
-	-	398	72	18
1	<1	340	31	9
1	<1	292	23	8
-	-	51	2	4
-	-	113	13	12
9	.4	2046 *	411	20

Table VI - 1

Haemoglobin levels by age and cohort

Age group (months)	Cohort	Haemoglobin level in gm %										
		4-4.9	5-5.9	6-6.9	7-7.9	8-8.9	9-9.9	10-10.9	11-11.9	12-12.9	13 +	Total No.
0 - 6	NS	0	0	2	2	3	6	5	2	0	2	22
	CC	0	0	1	0	1	2	3	4	1	0	12
	NS CC	0	0	1	5	10	12	6	3	3	6	46
	CONT	0	0	3	3	5	3	2	1	0	1	18
6 - 12	NS	0	0	1	4	11	9	12	2	1	0	40
	CC	0	2	1	5	8	7	2	1	0	0	26
	NS CC	0	0	2	9	19	24	13	5	1	0	73
	CONT	0	1	4	6	4	3	2	1	0	0	21
12 - 18	NS	0	0	2	1	4	2	6	0	0	0	15
	CC	0	1	8	9	2	2	1	0	0	0	23
	NS CC	0	1	1	8	7	14	8	1	0	0	40
	CONT	0	0	4	2	4	3	1	0	0	0	15
18 - 24	NS	0	0	0	4	5	9	6	3	1	1	29
	CC	1	0	5	10	8	6	2	0	0	0	32
	NS CC	0	0	2	8	21	16	11	2	0	0	60
	CONT	0	1	2	4	5	7	2	0	0	0	21
24 - 30	NS	0	1	1	1	2	3	4	2	0	0	14
	CC	0	2	4	14	5	4	0	1	0	0	30
	NS CC	0	0	3	7	7	18	7	2	0	0	44
	CONT.	0	0	1	8	3	1	1	0	0	0	14
30 - 36	NS	0	0	1	1	5	13	9	4	2	0	35
	CC	0	0	5	4	5	4	6	2	2	0	28
	NS CC	0	2	2	6	16	27	26	4	4	0	87
	CONT	0	1	0	6	5	3	0	1	0	0	15
36 +	NS	1	0	0	4	11	33	31	12	4	3	99
	CC	1	1	12	23	31	13	16	3	1	0	101
	NS CC	0	0	1	13	21	46	54	27	11	0	173
	CONT.	0	2	4	9	14	8	7	1	1	0	46
Total		3	16	73	176	242	298	243	84	32	13	1180
Percentage		68.5						31.5				

Average gm %	All cohort average for age group gm %
9.6 11.1 9.9 8.8	9.7
9.4 8.5 9.2 8.1	9.0
9.1 7.4 9.0 7.9	8.4
9.7 8.0 9.0 8.5	8.8
9.2 7.8 9.0 8.0	8.5
9.8 9.0 9.5 8.8	9.4
10.0 8.5 10.0 8.6	9.5
9.2	47

Table VI - 2

Haemoglobin level by cohort (All ages)

Cohort	Hgb. in gm %							
	4 - 4.9	5 - 5.9	6 - 6.9	7 - 7.9	8 - 8.9	9 - 9.9	10 - 10.9	11 - 11.9
NS	1	1	7	17	41	75	73	25
NS CC	0	3	12	56	101	157	125	44
CC	2	6	36	65	60	38	30	11
CONT.	0	6	18	38	40	28	15	4
ALL COHORTS	3	16	73	176	242	298	243	84

t value for difference between mean hemoglobin level of nutrition supplement and non supplement of 13.07 ($p < .01$) was found.

12 - 12.9	13 +	Total No.	Hgb. %	Average Hgb.
8	6	254	9.76	9.6
19	6	528	9.5	
4	5	252	8.4	8.4
1	1	151	8.4	
32	13	1180	9.2	

Table VI - 4

Stool findings on severe anemia cases 1970/71

Cohort	Total No. referred	Normal		Giardia L.	E. Coli	Ascaris	Hookworm	H. Nana	Total Abnormal	
		No.	%						No.	%
WS NSCC	47	36	76.5	4	3	0	2	2	11	23.5
NS	0	0	-	0	0	0	0	0	0	-
CC	0	0	-	0	0	0	0	0	0	-
NSCC	15	8	53.3	4	1	0	2	0	7	46.7
CONT	2	1	50.0	0	0	1	0	0	1	50.0
All	64	45	70.4	8	4	1	4	2	19	29.6

Except for the 0-6 months age group, haemoglobin levels of the child care and control cohorts are significantly lower than the nutrition and nutrition plus child care cohorts.

The average haemoglobin level for the nutrition supplemented villages thus came to 9.6 gm% whereas for the non-supplemented villages it was 8.4 gm %. This difference is statistically significant at the 1% confidence limit.

In addition to the cross-sectional haemoglobin survey, a total of 504 hgb. determinations by the Sahli technique had been performed in the nutrition villages. These included both referred cases (by physician, public health nurse or F.H.W.), treatment follow-ups and routine survey cases (as outlined under "Applied Research, Service Programs").

Most determinations were done in the NUT-CC and the NUT, least in the CC and control group of villages. As most of these determinations were done on referral the fact that the FHW was instructed per standing order to treat anemia in the nutrition supplemented villages only, whereas in the other cohorts neither nutrition advise nor treatment were given unless the hgb. level was found to be critically low, probably contributed to the marked difference in the number of referrals. (Table VI-3).

TABLE VI - 3

No. of Hgb. determinations per child by cohort

Cohort	No. children 0-3	No. of Hgb. determinations	No. of Hgb. determinations per child
NS	190	176	0.9
NSCC	356	441	1.2
CC	176	71	0.4
CONT.	169	16	0.1
All	891	504	0.6

Parasitological examination of stools were done mainly in severely anaemic children and yielded surprisingly few parasites (Table VI-4). This confirms the low parasite prevalence found in our earlier investigations, (see progress report 1968-69 page 16), and probably indicates that the main cause of anemia is nutritional deficiency.

C) T.B. Survey (Ballowal)

As part of regular health care several cases of tuberculosis among mothers and children came to our attention. For instance, a pair of third degree marasmic twins failed to respond to nutritional care and were found to be positive for TB on x-ray examination. Further examination showed that one of the 8 members of the family had TB.

A special survey was done in one village, Ballowal, to determine the extend of TB among a total village population especially among women and children. The survey consisted to chest radiography, Mantoux testing and sputum examination. Of the 1254 villagers five years and above, 1083 people were x-rayed. Mantoux testing was done on 1021 with I-TU, including 7 children under 5 years.

The following analysis is based on 1049 records: including 529 males, 513 females and seven children below five. Follow-up reading of Mantoux tests was not done on 212 people (167 males and 45 females). Table VII-1 and VII-2 gives the age ~~af~~ and caste breakdown of the persons screened by any of the test procedures.

Results:

1) Mantoux Testing:

Table VII-3 gives the Mantoux test results by age. Forty percent of 5-9 year old children were positive and in the 11-19 year age group 80% were positive.

Although analyses were done by age, caste and sex, the numbers were too small to give consistent results.

2) X-ray Findings:

Out of 1083 persons x-rayed 20 (1.8%) were positive, 11 males and 9 females (Table VII-4). There was a tendency for the men to fall into older age groups. Of the 20 x-ray positive cases, Mantoux tests were done on 16 and half (5 males and 3 females) were positive. All 20 cases have been put on regular treatment. Nine cases of TB had been detected in Ballowal prior to this survey. Six of these were confirmed by chest radiography but all were Mantoux negative (both I TU and S TU). Among these 4 children had third degree under-nutrition and this is known to diminish capacity to react to the Mantoux test. The miniature x-ray films showed no active lesions in these children, but they had calcified nodules and this also raises the possibility of histo plasmosis.

TABLE VII - 3

Result of Mantoux testing by age

Age	Positive		Total tested
	No	%	No
5-9	43	39	109
10-14	26	62	122
11-19	65	80	81
20-29	79	74	107
30-39	85	90	95
40-49	56	89	63
50-54	26	54	48
55+	61	79	77
Unknown	80	68	117
All	571	70	1819

Table VII - 1

Population screened for Tuberculosis by age in Ballowal

Age group in years.	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65+
No. of persons according to RHRC census.	161	173	128	119	72	65	67	45	55	59	36	32	83
No. of persons screened	122	139	103	77	58	45	63	39	37	33	31	23	54
Percentage of coverage	75.7	83.3	80.5	64.7	80.6	69.2	94.0	86.7	67.3	55.9	86.1	86.1	71.9

Not known	Total
-	1254
202	1134
65.1	-

Table VII - 2

Caste distribution of Population for Tuberculosis, Ballowal

Religion & Caste	Jats	Non.Sch. Non.Jat	Scheduled caste	Hindu & Muslim	Not known	Total
No. of persons according to RHRC Census	634	141	392	87	-	1254
No. of persons screened	533	112	296	75	18	1034
Percentage of coverage	84.1	79.4	75.5	86.2		82.6

TABLE VII - 4

X-ray diagnosis of TB cases by sex and age

Age Group	Females	Males	Total
0-19	-	-	-
20-24	0	-	-
25-29	1	-	1
30-34	-	-	-
35-39	1	1	2
40-44	2	-	2
45-49	1	1	2
50-54	-	1	1
55-59	-	2	2
60-69	-	2	2
70-79	1	3	4
80-89	2	-	2
Unknown	1	1	2
All	9	11	20
Median age	55.3	60.75	

D) Cross-Sectional Anthropometric Survey (July - August 1970)

Four physical measurements - namely, weight, height and circumference of health and chest - were obtained on 384 children under three years of age in a cross-sectional survey. Of these 202 were males and 182 females.

An attempt was made to study growth patterns for each sex. Using age as a dependent variable, prediction equations were obtained for each of the measurement variables for males and females separately. These are presented in Table VIII - 1.

TABLE VIII-1

Equations relating Age and Physical Measurements (By Sex)

	Equation	Coefficient of determination(R^2)
Weight - Male	$9.512 + 0.711A - .0098A^2$	.61
Female	$9.159 + 0.547A - .0066A^2$	.55
Height - Male	$54.652 + 1.621A - .0215A^2$	.83
Female	$55.126 + 1.345A - .0170A^2$	.78
Head - Male	$37.916 + 0.746A - .0139A^2$	.67
Female	$37.912 + 0.540A - .0086A^2$	.65
Chest - Male	$36.583 + 0.781A - .0145A^2$	.53
Female	$36.307 + 0.520A - .0066A^2$	.52

The percentage variations explained by age (in quadratic form) are also presented as R^2 - values in the same table.

The predicted values at selected ages according to these equations were also compared with the Harvard Standards.

TABLE VIII - 2

Punjab Predictions (P) Vs. Harvard Standard (H)

Age (Months)	Males			Females		
	P	H	H-P	P	H	H-P
Weight						
3	11.5	12.5	1.0	10.7	12.2	1.5
6	13.4	16.7	3.3	12.2	15.7	3.5
12	16.6	22.2	5.6	14.8	21.0	6.2
24	20.9	27.7	6.8	18.5	27.0	8.5
Height						
3	59.3	60.3	1.0	59.0	59.7	0.7
6	63.6	66.0	2.4	62.6	65.4	2.8
12	71.0	74.9	3.9	68.8	74.3	5.5
24	82.6	87.6	5.0	78.7	86.4	7.7
Head						
3	40.0	40.9	0.9	39.5	40.0	0.5
6	41.9	43.9	2.0	40.8	42.8	2.0
12	44.9	47.3	2.4	43,2	45.8	2.6
24	47.8	29.7	1.9	45.9	48.1	2.2
Chest						
3	38.8	40.6	1.8	38.0	39.8	1.8
6	40.8	43.7	2.9	39.4	43.0	3.6
12	44.0	47.6	3.6	41.8	47.0	5.2
14	48.2	50.8	2.6	45.2	50.1	4.9

Table VIII-2 . shows that Punjab children fall short of the Harvard Standards by increasing degrees as age advances and the amount of difference is more among females than male children.

Instead of comparing with Harvard Standards, it was thought reasonable to compare the weights of Punjab children with values which are equal to 70 percent of the Harvard Standards. As can be seen from Table VIII-3 the number of Punjabi children ~~xxxx~~ who did not achieve these reduced standards during the second year reached one third among males and almost two thirds among females.

TABLE VIII - 3

Percent of Study Children who Do Not exceed 70 Percent of Harvard Weight Standard (By Age Group and Sex)

Age Group (months)	Male	Female
1 - 6	20	7
7 -12	15	34
13 -24	32	60

E) Weight Survey (January - March 1971)

From January to mid April 1971 a cross-sectional weight survey covering 10 villages of the Nutrition project was carried out on a house to house basis. The principal objectives of this survey were:

1) to detect "hidden" cases of malnutrition; i.e. children, who are malnourished according to the R.H.R.C. classification (see Appendix B) but had escaped for one reason or another the attention of the village FHW,

2) to measure the impact of our Nutrition Supplement Program on weight gain,

3) to serve as a quality control of the FHW's routine anthropometric measurements, and

4) to detect "new" children; i.e. to see if there are children who are between 0 to 3 years of age, reside permanently in one of our study villages yet do not appear on our population registers.

1130 children from 0 to 3 years of age out of a total 0 to 3 population of 1297 were weighed either in their homes or the subcentre clinic. Most of the 167 not weighed were either out of the village at the time the survey was conducted or refusals. Table IX-1 gives a breakdown of the coverage of the weight survey by cohort.

TABLE IX - 1

Proportion of Children Weighed by Cohort

COHORT	Total child population 0 to 3 yrs		No. of children weighed		% coverage	
WSNUTCC	406		378		93.3	
NUT	190		148		78.0	
CC	176	891	169	752	96.1	34.4
NUTCC	356		299		84.0	
CONTROL	169		136		80.5	
All	1297		1130		87.1	

Note: WSNUTCC = Womens Service, Nutrition Supplement, Child Care
NUT = Nutrition Supplement alone
CC = Child Care (Medical Care) alone
NUTCC = Nutrition Supplement, Child Care
CONTROL = Control villages
} Nutrition study cohorts

In Table IX-2 the children weighed are classified by age group, caste and cohort. Table IX-3 shows the average weights per ages. As can be seen, Jat children have higher weights for all ages, even though their rate of weight gain, as demonstrated graphically by the slope of the curve on Figure IX-1 is more or less the same as that for Ramdasia children until about 27 months of age. Both castes show a flattening of their weight curves between 100 and 22 months for Jats and between 15 and 22 months for Ramdasias; period corresponding approximately with the ages at weaning in these two groups. Since the third group labelled as "Other" comprises a rather non-homogeneous population ranging from the very poor to the very rich, and since in some cohorts their numbers were few, they have been excluded from detailed analysis. On Figure IX-1 they can be seen to occupy an intermediate position.

When we separate out the cohorts receiving supplemental feeding (WSNUT, NUT, NUTCC) from the Control group, a clear difference in weight curves can be observed (Figure IX-2), (Table IX-4), with the Ramdasia controls showing the lowest and the "supplemented" Jats the highest weights per given age group. This becomes even clearer when the WSNUTCC group of villages were

Table IX - 2

Number of children by age caste and cohort

AGE	WS			NUT			CC			NUT CC		
	JAT	RAM	OTHER	JAT	RAM	OTHER	JAT	RAM	OTHER	JAT	RAM	OTHER
0 - 6	29	27	11	8	10	5	16	10	6	13	28	6
6 - 12	21	31	13	5	7	4	16	6	6	11	21	7
12 - 18	26	32	9	26	6	4	10	7	9	23	31	17
18 - 24	24	31	15	7	4	3	18	8	9	13	20	11
24 - 30	33	30	10	18	10	11	18	8	5	23	30	7
30 - 36	16	18	2	11	6	3	7	4	5	11	16	11
TOTAL	149	169	60	75	43	30	86	43	40	94	146	59

CONTROL			ALL			TOTAL
JAT	RAM	OTHER	JAT	RAM	OTHER	ALL
9	7	5	75	82	33	190
10	9	11	63	74	41	178
11	8	1	96	84	40	220
14	5	8	77	68	46	191
7	11	4	99	89	37	225
8	5	3	53	49	24	126
59	45	32	463	446	221	1130

Table IX - 3

AVERAGE WEIGHT FOR AVERAGE AGE BY AGE GROUP CASTE & COHORT

Age Group	Caste	WS Age	WS Wt	WS N	NUT Age	NUT Wt	NUT N	CC Age	CC Wt	CC N	NUT CC Age	NUT CC Wt	NUT CC N	CONT Age	CONT Wt	CONT N
- 6	Jat	3.8	5.6	29	3.5	5.3	8	3.7	5.8	16	3.6	5.8	13	3.5	5.6	9
	Ramdasia	3.7	5.5	27	4.0	5.1	10	2.6	4.5	10	3.5	5.2	28	3.6	5.3	7
	Other	3.5	4.8	11	4.3	5.0	5	2.7	4.6	6	3.7	5.4	6	4.5	6.4	5
6 - 12	Jat	9.6	7.9	21	9.4	7.7	5	8.1	6.8	16	9.2	7.4	11	8.8	7.3	10
	Ramdasia	8.6	6.6	31	8.7	6.3	7	8.0	6.5	6	8.9	6.7	21	9.6	6.7	9
	Other	9.0	6.6	13	9.9	8.3	4	9.8	8.0	6	9.9	7.0	7	10.0	7.0	11
12 - 18	Jat	15.2	8.8	26	15.4	9.0	26	15.6	8.5	10	15.7	8.5	23	15.8	8.6	11
	Ramdasia	15.1	7.8	32	14.7	9.1	6	16.1	7.6	7	15.2	8.0	31	15.5	8.1	8
	Other	14.8	8.2	9	15.8	8.4	4	14.9	7.6	9	15.3	8.8	17	17.0	9.5	1
18 - 24	Jat	21.3	9.5	24	20.7	9.6	7	21.8	9.4	19	21.8	9.4	31	21.0	9.5	14
	Ramdasia	21.8	8.7	31	21.3	8.6	4	20.8	9.5	8	22.2	9.2	20	21.8	8.4	5
	Other	21.7	9.4	15	20.7	10.7	3	21.9	8.3	9	23.0	9.3	11	20.6	10.8	8
24 - 30	Jat	27.9	10.7	33	26.9	10.7	8	27.4	10.4	18	27.7	10.6	23	27.5	9.8	7
	Ramdasia	27.3	10.0	30	26.8	10.4	10	28.5	9.6	8	28.0	9.9	30	27.2	9.0	11
	Other	27.4	10.0	10	27.4	10.8	11	29.4	10.1	5	28.1	10.3	7	26.7	8.8	4
30 - 36	Jat	34.3	12.5	16	33.4	11.6	11	33.3	11.8	7	33.6	12.0	11	33.0	11.4	8
	Ramdasia	33.9	10.8	18	32.3	10.7	6	33.0	8.6	4	32.9	11.3	16	33.3	10.5	5
	Other	36.0	14.0	2	34.7	12.7	3	34.2	10.0	5	32.7	10.4	11	32.3	10.3	3

ALL			Total Number all castes
Age	Wt	N	
3.6	5.6	75	190
3.5	5.1	92	
3.7	5.2	23	
9.0	7.4	63	178
8.8	6.6	74	
9.7	7.5	41	
15.5	8.7	96	220
15.3	8.1	84	
15.6	8.5	40	
21.3	9.5	77	191
21.6	8.9	68	
21.6	9.3	46	
27.5	10.4	99	225
27.6	9.8	89	
27.8	10.0	37	
33.5	11.9	53	126
33.1	10.2	49	
34.0	11.5	24	

Figure IX 1
Average weight (kg.) for average age (Months)
by caste (Total population weighted)

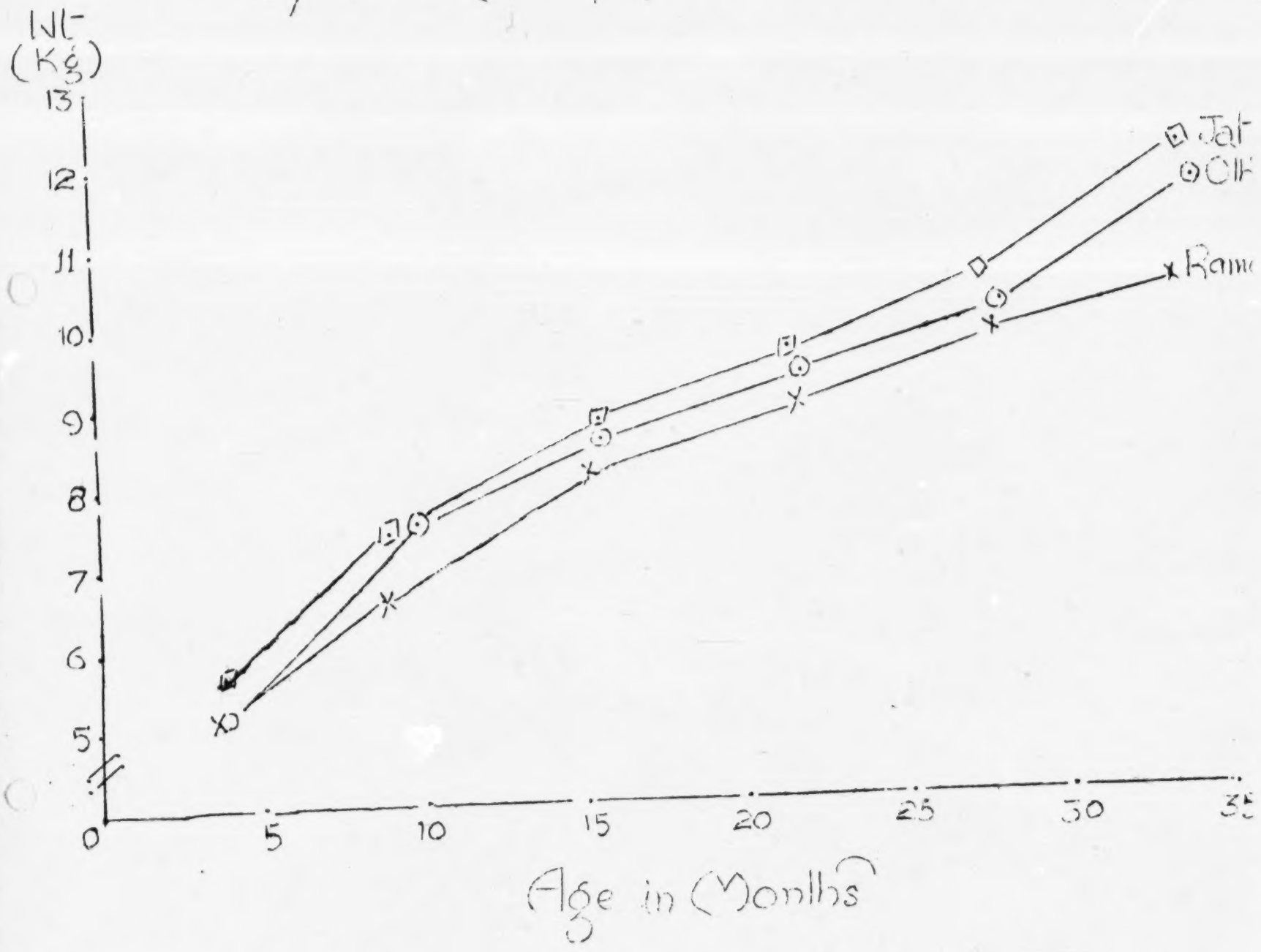


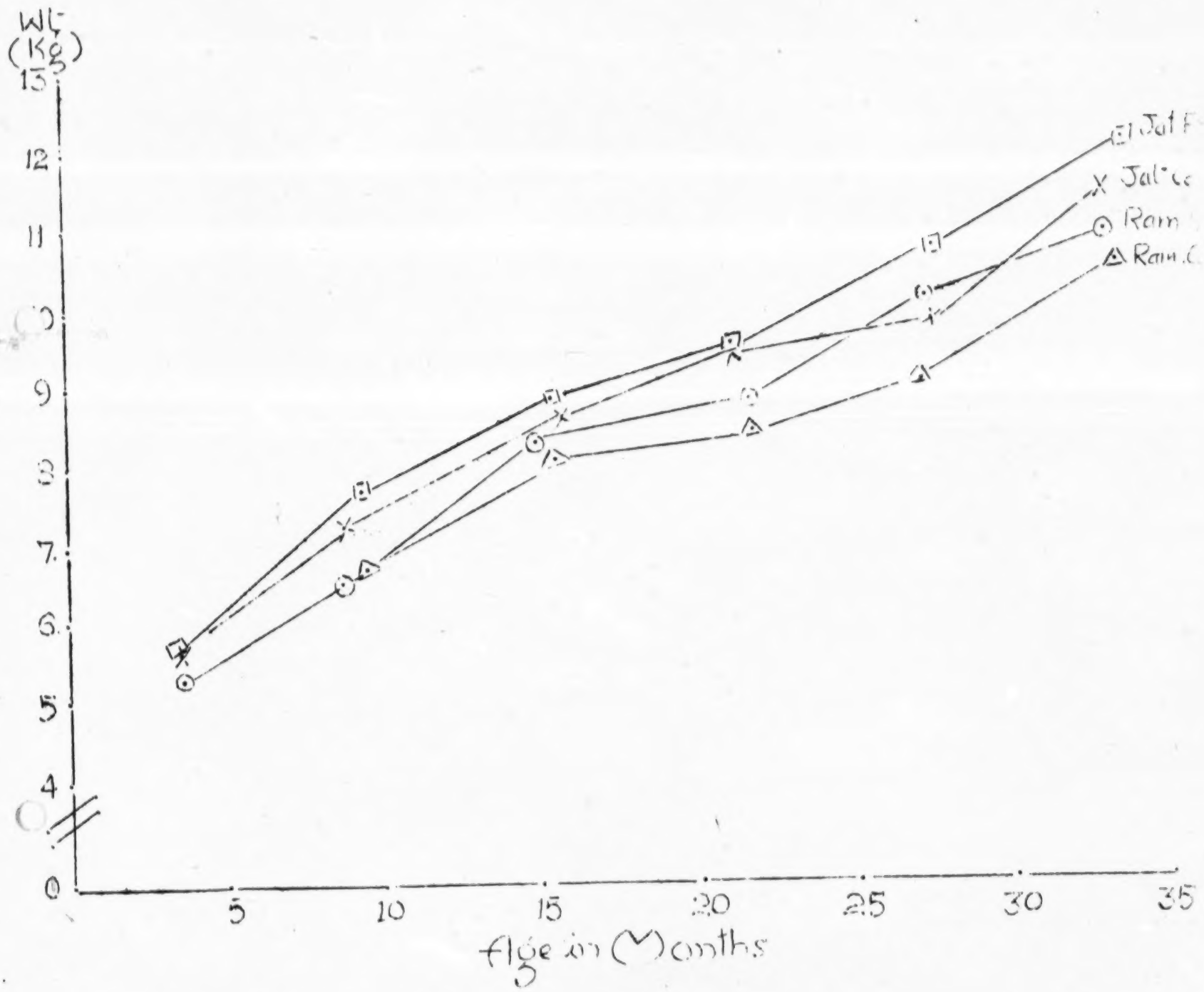
Table IX - 4

Average weight for average age by age group, main caste & cohort group

Age	Caste	Supplementary Feeding NS, NSCC, WSNSCC			Control only			Supplementary Feeding NS, NSCC		
		Age	Wt	No.	Age	Wt	No.	Age	Wt	No.
0 - 6	Jat	3.6	5.6	49	3.5	5.6	9	3.7	5.6	21
	Ramdasia	3.7	5.3	66	3.6	5.3	7	3.6	5.2	38
6 - 12	Jat	9.4	7.7	34	8.8	7.3	10	9.3	7.6	13
	Ramdasia	8.7	6.5	59	9.6	6.7	9	8.8	6.6	28
12 - 18	Jat	15.4	8.8	75	15.8	8.6	11	15.6	8.8	49
	Ramdasia	15.0	8.3	70	15.5	8.1	6	15.1	8.2	38
18 - 24	Jat	21.3	9.5	40	21.0	9.5	14	21.3	9.5	16
	Ramdasia	21.8	8.8	48	21.8	8.4	5	22.0	9.1	17
24 - 30	Jat	27.5	10.7	71	27.5	9.8	7	27.4	10.6	38
	Ramdasia	27.4	10.1	70	27.2	9.0	11	27.7	10.0	40
30 - 36	Jat	33.7	12.0	35	33.0	11.4	6	33.5	11.8	19
	Ramdasia	33.0	10.9	40	33.3	10.5	3	32.8	11.1	22

Figure IX 2

Average weight and Average age by caste and cohort (including WS, NS, CC)



Jat receiving food supply — Jat S.F.
Jat control — Jat Cont.
Ramdasia receiving food supply — Ram S.F.
Ramdasia Control — Ram Cont.

Figure IX 3

Average weight for Average Age by caste and colour (excluding WS NS. CC)

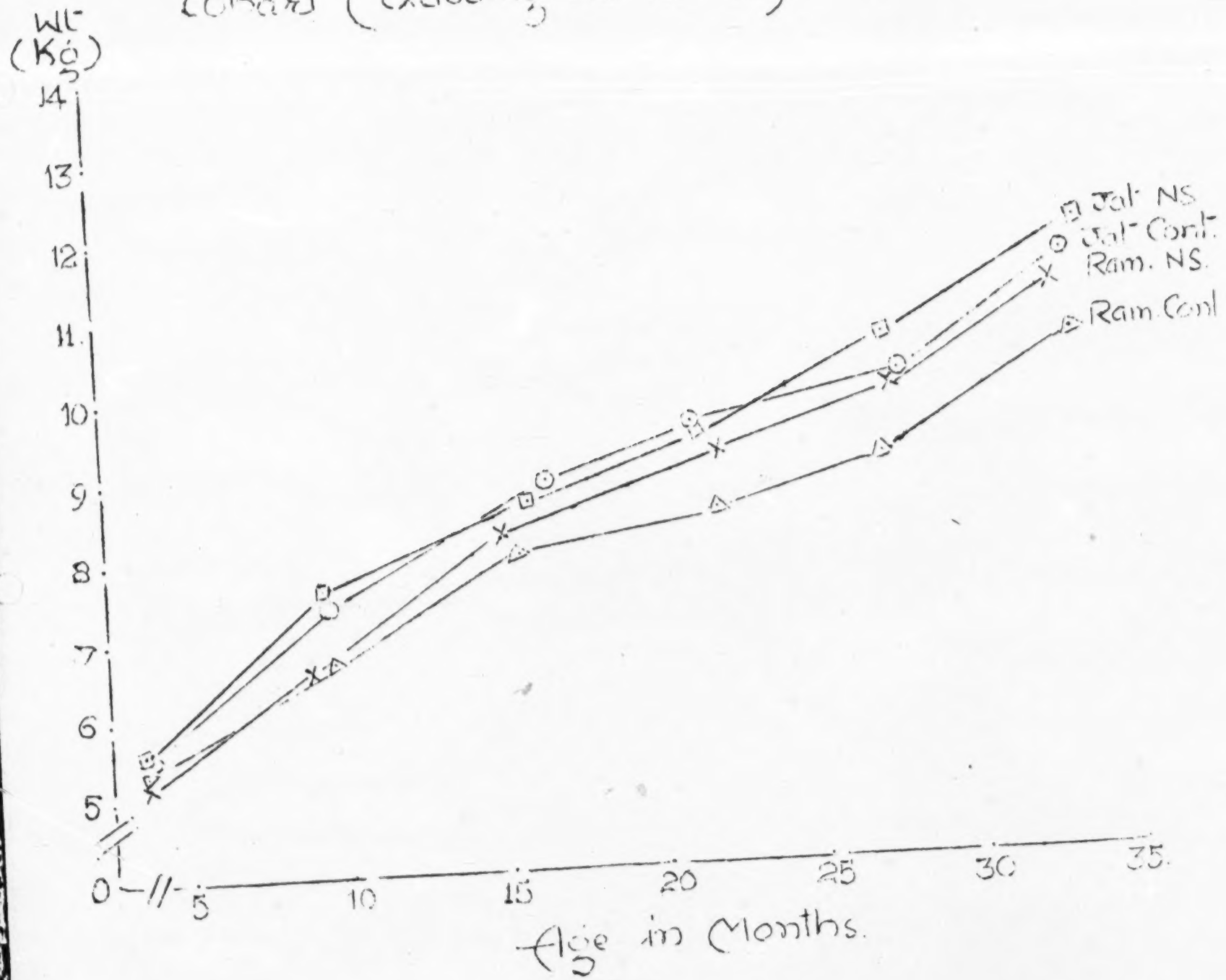


Table IX - 5

Number of malnourished children by caste sex and cohort

COHORT	BOYS						GIRLS					
	JAT			RAMDASIA			JAT			RAMDASIA		
	Total	Malnourished	%	Total	Malnourished	%	Total	Malnourished	%	Total	Malnourished	%
WS NS CC	86	4	4.7	98	15	15.3	63	10	16.0	71	26	36.6
NS CC	53	4	7.5	79	5	6.3	41	6	14.6	67	27	40.3
NS	43	1	2.3	26	3	11.5	32	7	21.9	17	6	35.3
CC	44	2	4.5	18	2	11.1	42	7	16.7	25	11	44.0
CONTROL	32	3	9.4	25	7	28.0	27	8	29.6	20	10	50.0
ALL	258	14	5.4	246	32	13.0	205	38	18.5	200	80	40.0

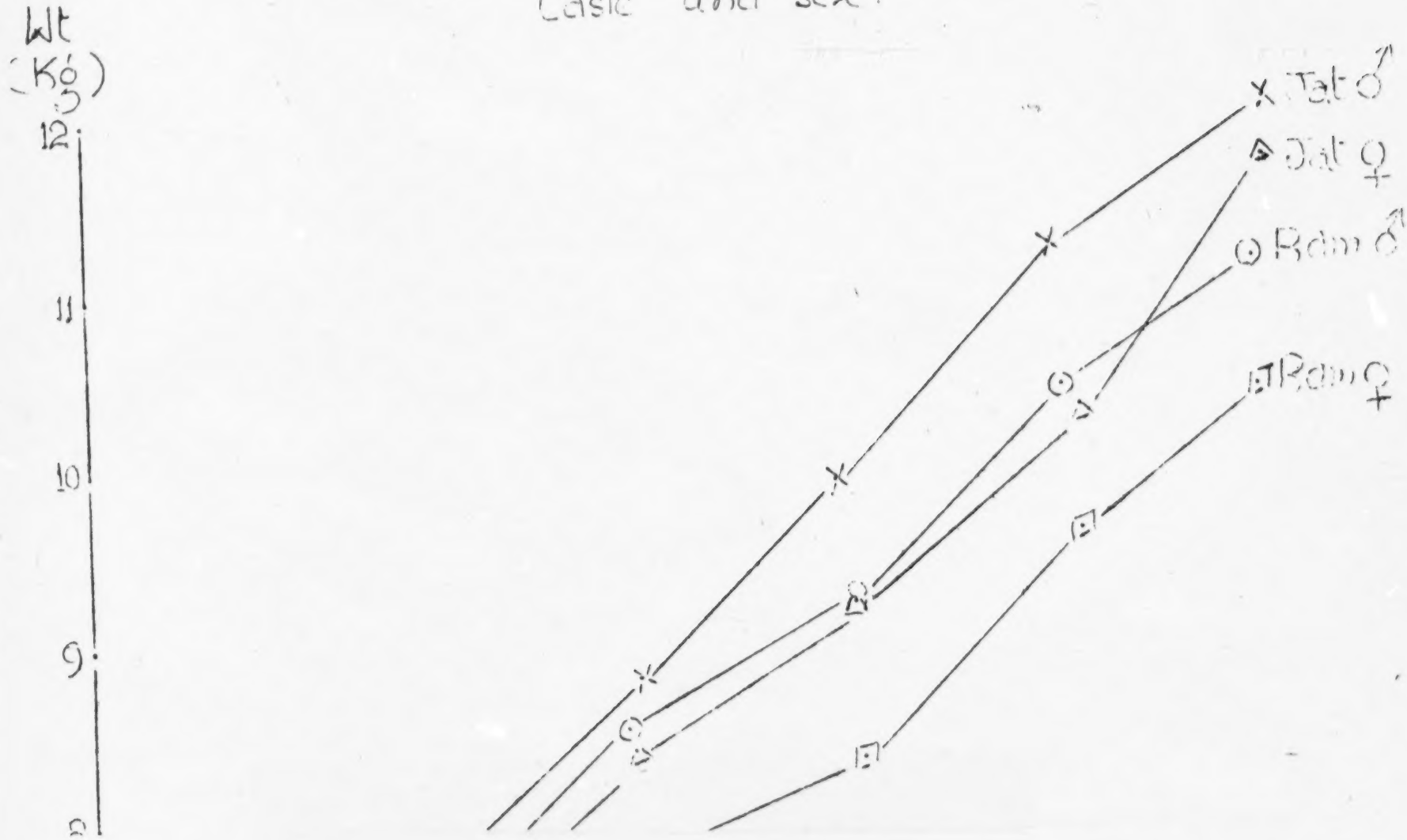
Table IX - 6

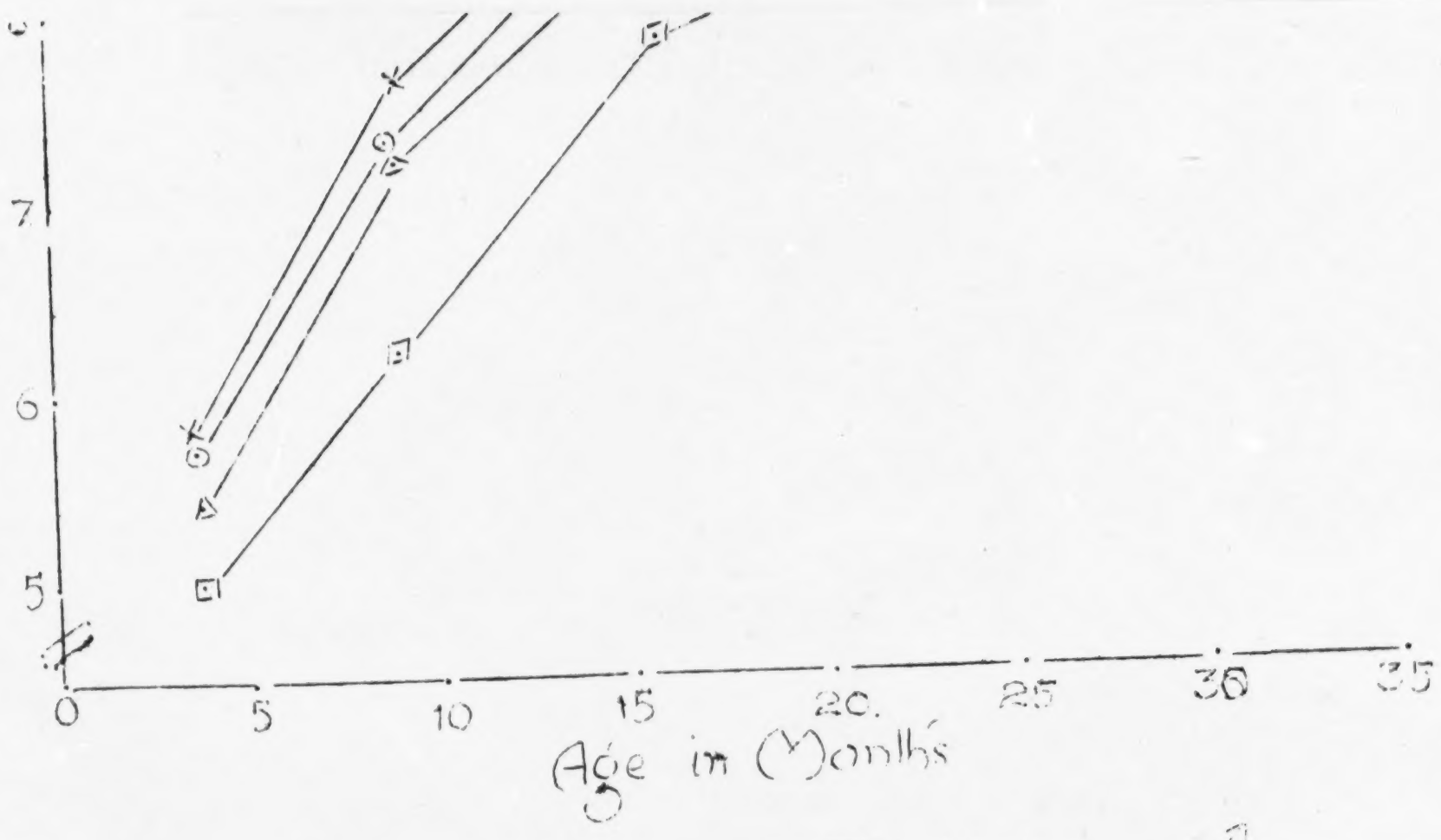
AVERAGE WEIGHT FOR AVERAGE AGE BY CASTE AND SEX (ALL COHORTS)

AGE GROUP	JAT MALE			RAMDASIA MALE			JAT FEMALE			RAMDASIA FEMALE		
	AGE	WEIGHT	No.	AGE	WEIGHT	No.	AGE	WEIGHT	No.	AGE	WEIGHT	No.
0 - 6	3.5	5.8	40	3.6	5.7	38	3.8	5.4	35	3.7	5.0	44
6 - 12	8.9	7.6	34	8.7	7.3	40	8.9	7.2	29	8.8	6.2	34
12 - 18	15.6	8.8	60	15.1	8.5	44	15.3	8.4	36	15.8	7.7	40
18 - 24	21.2	9.9	40	21.8	9.2	42	21.6	9.2	37	21.8	8.3	26
24 - 30	27.5	11.2	51	27.8	10.4	53	21.2	10.3	48	28.2	9.6	36
30 - 36	33.6	12.0	33	33.2	11.2	29	33.5	11.7	20	30.3	10.4	20

Figure IX 4

Average weight for Average Age by Caste and sex.




7
6
5
0
5
10
15
20.
25
30
35
Age in (Y)onths
Jat Male
Jat Female
Ram Male
Ram Female

where services have been building up more slowly than in the other cohorts, is separated out (Figure IX-3).

Table IX-5 gives a breakdown of all malnourished children (under 70% of Harvard average weight for age) according to sex, caste and cohort. There are several rather interesting observations that can be made.

1) The control cohort has for every group the highest percentage of malnourished children. This difference was statistically significant at the 5% confidence limit. This study was done cross-sectionally in between January and May. This bridges the period between seasonally good and poor nutrition.

2) The porportion of malnourished females in either caste is significantly larger than that of malnourished males.

3) The caste difference with respect toprevalence of malnutrition is rather marked. Whereas for the Jats 5.4% of males and 18.5% of females are malnourished, for the Ramdasia the corresponding figures are 13.0% and 40.0%.

4) Within each caste, there are approximately 3 malnourished girls per malnourished boy. Thus the female: male ratio for malnourished children is 3.5 for Jats and 3.1 for Ramdasias.

In Figure IX-4 (Table IX-6) average weights for age are plotted by sex groups. Whereas Jat males show a more or less uninterrupted weight curve, all other groups show some break in their weight gain at about weaning age with Ramdasia females clearly showing the least growth.

E. Detailed Findings - Applied Research

1. General Service Program

From the beginning, one of the aims of all Narangwal research has been to evolve patterns of health care that are reproducible under the conditions of regular government health services. Programs for the most vulnerable groups in the population, especially pre-schoolers and pregnant women, have highest priority. The Nutrition project is concerned not only with research involving 0-5 year olds, but also provides a base for the development of a practical child care service program. The present content of child care services in the Nutrition plus Medical care cohort, (CC, NUT) will be summarized to show what has evolved thus far. (See also the child care manual in Appendix D).

2. Prenatal Preventive Programs

a) Fertility survey

A continuing prospective fertility survey of all women in the reproductive age groups (15-49) has been in operation in all villages of the Nutrition project since January 1970. At present the total population surveyed in the NUT project consists of 1767 women in the reproductive age groups. All eligible women are questioned about their last menstrual period at 2 monthly intervals.

This survey, at present serves the following purposes:

i) to identify at an early stage all pregnant women in order to permit us to provide prenatal care as described below:
ii) to alert us to the date of delivery and thus permit the FHW to provide postnatal care promptly.
iii) to alert the FHW to the important points in the care sequence when decisions about family planning may be most readily influenced.

b) Tetanus vaccination to the pregnant women. Neonatal tetanus figures importantly in hospital records and is one of the major causes of death in the perinatal and neonatal period. Although in our own "verbal autopsy" survey of children in our care program we have only come across 1 probable case of tetanus upto the present.

c) Nutrition advice and education for pregnant women identified through the fertility survey.

d) Nutritional supplements for pregnant women falling below a given weight for height ratio.

e) Iron and folic acid administration for pregnant women with hgb below 10 mg%.

In our progress report 1968-69 we reported that 57% of women in one of our villages had haemoglobin levels below 10 gr%. By giving iron and folic acid to pregnant women we hope to be able to build up their hgb as well as the growing foetus' iron stores.

3. Postnatal Preventive Programs.

1) Routine follow up of newborn children.

a) Deliveries are conducted by village Dais but our FHWs provide support and are available for consultation. Prompt referral of complications is encouraged. Examination and care of the newborn is a responsibility of the FHW. Every newborn infant is seen 24 hours, 2, 6 and 9 days postnatally. (See paper on neonatal child care in the attached manual).

b) Monthly physical examination

c) Monthly morbidity data collection to detect aberrations from health at an early stage.

d) Treatment 'on the spot' of minor illness and ailments.

e) Referral to the project physician of any serious disease or any case which the FHW feels she cannot handle on her own.

f) Hgb. determination for every child once every 3-6 months by the Sahli method to provide early detection of anemia and initiate parasitological investigation and appropriate treatment (see longitudinal haemoglobin survey).

g) Examination for neurological and neuromuscular development by collection of 'milestone' data at fixed ages to detect early falterning and initiate appropriate investigations. These studies are still being pretested.

h) Anthropometry at intervals depending on the age of the child (monthly from 0-9, two monthly from 9 to 21, and three monthly from 21 to 36 months of age) to assess weight gain and physical growth. Any child found to falter in its expected growth and weight gain and coming into any of the 3 degrees of malnutrition is directed to either the project physician or the feeding center.

4. Immunization

Within 6 weeks of birth 2/3 of all children are routinely inoculated with BCG, 1/3 being controls in a study examining the effects of vaccination on short-term weight gain. At the age of 3 months all children are given small-pox and at 4,5 and 6 months DPT immunizations. This is an ongoing vaccination program started April 1, 1971, vaccination against smallpox and DPT continues to be on a campaign basis as before.

BCG is given by the project physician who visits new births in a 2 to 3 day period during the first week of every month. Children reaching 3 months of age are given smallpox vaccination one day per month by the male family planning worker of each of villages. To assure ongoing vaccination the FPW of each cohort receives a list of the children to be vaccinated by the 10th day of each month. This is made possible by keeping a central vaccination register according to which all new born infants after having received BCG are filed under the month at which the next immunization is due. One, two and 3 months following smallpox vaccination the child receives its three DPT injections. These are given by the FHW one day per month.

5. Curative Care

a) Treatment for minor ailments occurs 'on the spot' in the home or in the subcenter clinic which is held every afternoon. Children found to be ill are regularly followed up as explained in the child care manual. (see appendix).

b) More serious illnesses or problem cases are referred to the project physician who comes once weekly to hold a regular clinic. If the disease is life threatening the project physician at Narangwal is summoned to attend to the child immediately, or, if expedient, the child is brought to the physician.

6. Community Participation

As has been shown in studies all over the developing world, the 0-3 year age group is especially vulnerable to interactions of malnutrition and infection. To meet this challenge in villages some basic questions must be resolved. How can parents become more aware of their children's needs and the possible solutions ? How can we draw the attention, concern and interest of the community to the problem so that they will take continuing responsibility ?

With these questions in mind we have started 2 pilot projects, which we intend to evaluate and expand in the coming year.

a. Community Supported Feeding Centres

Any program hoping realistically to achieve widespread application must be as independent from outside (domestic or foreign) help as possible. Outside help can not be relied on for long term continuity. Each help is also often not really appreciated by village people as indicated by the tendency to use such services less efficiently than local supported activities.

To get community involvement therefore, a proposal was made to village panchayats that they:

i) appoint a person as their representative to be responsible (with the village FHW) for each feeding center and its proper functioning.

ii) to supply whatever local foods and other material that are needed to prepare nutritious and locally acceptable infant and toddler food. Our nutrition laboratory has worked out several diets prepared from locally available food which will supply the nutritional requirements of 0-3 year old child (see appendix C).

iii) to gradually take over more and more responsibility for feeding center operations through gradually increasing their share of the running expenses.

It is our expectation that our village communities are interested in and able to provide the necessary food and supplies for the maintenance of the feeding centers. We also think that attendance at a community maintained feeding center should increase.

This program was started first in the Pakhowal groups of villages (WS NUT CC) and was introduced in the following sequence.

The Project Officer concerned together with a social scientist and the village FHW first contacted each panchayat and discussed the above proposal assuring them of our help and guidance. We asked the panchayat whether land holding families would be willing to donate a specified amount of food after the harvest for the use of the feeding centre.

At present the panchayats and the people of 3 villages (Chaminda, Dhaipee and Ballowal) have been contacted and all have agreed

a) on the usefulness of the feeding station
b) to provide at the end of harvest 4-10 kgs of wheat per land holding household for this purpose.
c) to provide storage facilities.
d) under the supervision of their appointed members to permit the selling of excess wheat so that the proceeds can be used for the purchase of other food materials such as jaggery (crude sugar), milk, sugar and oil or to help pay the attendant's salaries. By the end of the April-May 1971 harvesting season the following amount of wheat had been collected:

	Dhaipee	Chaminda	Ballowal
1. Kg of wheat collected	800	800	850
2. Kg of wheat estimated to be used	700	500	400
3. Kg of wheat left to sell	100	300	450

The role of the appointed community representatives has been defined as follows:

a) Supervise collection of raw food during harvest season.
b) Arrange for storage space for the collected wheat.
c) Supervise the sale of the excess wheat and purchase other required food material.
d) Serve as intermediary between the community and feeling center.

b) Day Care Centre

During the harvesting season (April-May) often both parents together with older children are out in the field from very early in the morning to late at night, leaving the pre-schoolers (0 to 3) in the care of only slightly older siblings or people too old or too sick to go out to help in the fields. This is particularly true for infants and toddlers of the scheduled castes. This 'arrangement' has a disastrous effect on the child's nutritional status since he is often already in a rather precarious balance.

In April-May and part of June of 1969, day care centers were established in two of our study villages (Ballowal and Rattan). These centers were well received by the community and produced an apparentreduction in child morbidity. This work, however, required a great input of manpower and working time and it was not possible to reopen them in 1970.

The following considerations justify a better controlled trial.

1) There is a decided need for this kind of service in the community which we should try to meet through simpler methods.
2) The deterioration of growth and high morbidity of pre-school children during the harvest season, is most probably due to child neglect and resulting malnutrition during this period. Additional factors such as the effects of heat and of diarrhea and other summer infections also have an obvious synergistic action.

3) The provision of day-care and nutrition may demonstrate to the community the causal relationship between malnutrition and infectious diseases and thus serve as an educational tool.

4) If the project succeeds, the community may be persuaded to contribute towards or take over wholly the maintenance of future day-care centers thus establishing another reproducible pattern in promoting local initiative in efforts to improve child health.

5) A special opportunity is created in which a group of children can readily be studied for short periods with respect to improvement in nutritional status, Hgb. levels and other biochemical indices of nutritional status. It also provides opportunity for controlled administration of food supplements and, if necessary iron and folic acid.

It is expected that regular day care and feeding supplements to children 0-3 years of age during the harvesting season will provide measurable improvement in the following parameters:

1) Growth and Development (as measured by routine anthropometry)
2) Morbidity experience
3) Biochemical Indices of Nutrition such as Hgb. These variables will be compared with a control group in a village not supplied with this service.

Early in March 1971 the Sarpanch and through him the community of Rattan was approached by the Project Officer, the Social Scientist, the PHN inharge of supervision in that village and the PHN with the following proposals:

1) establishment of a Day Care center
2) appointment of a panchayat member to help with organization.
3) their contribution in kind of diapers, toys, food, mats, charpoys, kitchen utensils, garments. etc.
4) appointment of one or two village women as attendants to be remunerated in cash or kind by the community

RHRC in turn would provide some food, and personnel (2 Feeding Center attendants, 2 Bal Sevakas, one person to direct the day care center plus the PHN to be responsible for training of personnel, organising and supervising the center.

The Panchayat finally agreed to:

1) Nominate 4 to 5 people from the village who would regularly visit the day care center during the 4 to 6 weeks of its existence.
2) Collect wheat following the harvest for future use of the feeding station as outlined under community supported feeding centers.
3) Make provision for storage of the donated grain.
4) Undertake general repairs needed in the feeding center.

Twelve children from the Ramdasia caste were cared for from April 15 to the latter half of May. In the first week of the center's operation, all children were assessed with respect to:

1) Anthropometry - present and past (last 12 months)
2) Morbidity - review of morbidity experience of last 3 months
3) Hemoglobin by colorimetry
4) Stool examination.

The daily food intake of each child was quantified, daily morbidity records were kept, complete anthropometric measurements were taken once every week. Children with hemoglobin levels below 8 gm% were given daily iron and folic acid.

7) Family Planning

The relationship between our nutrition and population projects is synergistic in many shared procedures and personnel. It is also synergistic in sharing of villages to economize on total logistic costs of this kind of research. The Pakhowal group of villages is referred to frequently in this report because of the child care and nutritional supplements provided there but these villages are part of the population study. Similarly, we now are introducing family planning selectively into nutrition project villages. Partly, this is in response to popular demand. It is also expected that careful analysis of results will give evidence of program interactions between family planning and nutrition programs. Because of the considerable current interest in this issue we feel that we should proceed even though the addition of this variable into the research design complicates the analysis.

Family planning services have been started in this cohort in February 1971. The cafeteria approach has been adopted giving the couple a choice of family planning methods. Both the husband and wife are regularly contacted both by a male FPW who covers four villages and the FHW who lives in the village respectively. Once a week a family planning clinic is heldin the village by a Lady Medical Officer.

IV. In-Service Training Program

A. Educational Objectives

The training of the FHW is basic to our total activities. The pattern of in-service training is derived from an analysis of the requirements of the research and service programs. Educational objectives were spelled out according to the functions of nutrition, child care and Family Planning as follows:

1. Nutrition

a. Take anthropometric measurement of children and be able to classify the children according to standard weight categories.
b. Prepare a list of children needing nutritional treatment.
c. Explain to mothers the hazards of under nutrition and protein calorie malnutrition and to encourage regular attendance of the feeding centre.
d. Teach attendants the preparation and distribution of weaning food and maintenance of attendance registers.
e. Do dietary surveys of children and give dietary advice to the mothers.
f. Follow standing orders on follow-up of non-attenders.
g. Refer malnourished children who fail to gain weight to physicians.
h. Handle administrative tasks (progress reports monthly attendance register, food requisition forms, stock register).

2. Child Care

To enable the FHWs:

a. Prepare and maintain her home visiting bag and subcenter clinic so that routine activities can be carried out.
b. While home visiting to systematically carry out all required tasks (physical examination, morbidity data collection, milestones collection) and to record them correctly.
c. Recognize symptoms of common illnesses.
d. Follow standing orders in treating minor illnesses and the verbal and written instructions of supervisor and physician for care of referred children.
e. Administer prescribed or indicated drugs appropriately (giving of injections, crushing tablets, dividing tablets, etc.).
f. Plan her use of time so that the routine tasks assigned to her are carried out within the prescribed periods of time and according to set criteria of quality.

3. Family Planning

To enable the FPW to:

a. Explain and answer questions about pregnancy outcome and the physiology of human reproduction correctly in terms that villagers will understand.
b. Explain reasons for family planning in terms that are meaningful to villagers.
c. Explain clearly all methods of birth control now available and the advantages and disadvantages of each.
d. Introduce the idea of family planning to village women during child care and fertility surveys at appropriate points.
e. Carry out a program of distributing conventional contraceptives and to follow-up acceptors.
f. Refer patients to physicians for pills, loops, injections and tubectomies and to carry out appropriate follow-up programs.
g. Establish a working relationship with the male FPW for two-way referral and to help motivate husbands to accept condoms or vasectomy.

h. Develop close and cllaborative relationships with indigenous Dais and to get them to participate in a training program.
i. Maintain records of family planning work and to prepare a monthly report.

B. F.H.W. Staff Changes

The present staff of FHWs includes:

11 Lady Health Visitors staffing the 10 sub centers of the nutrition study villages with large villages having two and two small villages being covered by one FHW.
2 Relievers - to cover for vacations and illness.
1 Lady Health Visitor checking full time on the repeatability of longitudinal studies.

The major changes in staffing during the past year have been because:

1) The nutrition study sub centr was closed in Rurka because a government subcentre became very active in this village.
2) Six lady health visitors resigned and one was promoted to be a field supervisor in the population project. Seven were hired as replacements.

The main reasons for resignations were:

marriage with shift of residence	3
family matters	2
found job closer to home	1

C. Selection of Staff

To hire new staff, an advertisement is placed in local newspapers and the employment exchange is contacted. All those who reply to the advertisement and those who are named by the employment exchange are called for interview, if they are graduates of a recognized LHV school.

Then the candidates appear they fill an application form that includes items pertaining to background, education, work experience. They then take a Raven matrix test which is a standard non-verbal measure of an individual's capacity for observation and clear thinking. An interview is conducted jointly by the Project Officer, a supervising physician and the PHN supervisors who will work directly with the FHW and is decisive in selection. Desirable qualities are an ability to speak Punjabi fluently, have worked in a rural sub-center, have lived in a village, be able to answer questions on MCH, achieve above the 50 percentile in the Raven's matrix test, and be able to ride or willing to learn to ride a bicycle.

D. Orientation Program

Those hired are then given orientation program to learn about the project and their future tasks. The orientation program has the following objectives:

1. To enable the FHWs:
   a. to understand the administrative system of R.H.R.C.
   b. to know the focus, scope and limits of her activities in the sub center
   c. To know the principles, procedures and standing orders for care of children and family planning.
   d. to start taking responsibility for carrying out specific duties in the village sub centre while still in training.

2. To enable the senior staff:
   a. to determine the FHW's capacity to learn and to do effective work.
   b. to decide assignment to village
   c. to make plans for additional training.

We have moved from the rather academic training that we had to develop for the first group of FHWs. We now use the present staff as preceptors.

The orientation program in June and April were similar. They spent one day at the centre for introduction and then were rotated for two weeks each in the control, nutrition, medical care and medical care nutrition and family planning villages of the project. During this eight week period they lived and worked with an experienced FHW in the village. Weekly the supervisor visited the village where the FHW under training was posted to explain and discuss the work and program. Each week the FHWs attended the inservice training program planned for the larger group.

In the October training program during alternate weeks the new personnel spent full time in a village with an experienced FHW. Then in the other weeks they worked in a village in the morning while in the afternoon and on Saturday morning they had classes, discussion of their field work and review of problem cases. Each Thursday they attended the in-service training program for the larger group. Approximately thirty hours of classes, not counting those on Thursday in service program, were given.

Evaluation of the orientation program has been only informal through the progressive changes that have been made. The program has, gradually evolved to being very practical in meeting the service and research aims of the project. The major emphasis is on continuing education.

Since the responsibilities of RHRC lady health visitors are considerably different from those for which LHVs are originally trained, a manual specifically for our FHWs was prepared in 1968-69 (see progres report for 1968-69). Even with continuing changes the original document is no longer adequate to serve our purpose. Many changes in data collection, service systems and subcentre administration have been made. A new updated document is being prepared. At the time of this report the first draft for the nutrition supplement cum medical care cohort of villages is completed.

E. Continuing Training Activities

A weekly training session is held with family health workers being brought together at Narangwal - usually on Thursdays. A total of forty-three sessions were held from May 1,1970 to April 30,1971. These sessions include approximately 4 hours of teaching - learning. The visit to the research base also permits other activities such as arranging travel, receiving drugs, supplies and pay and other administrative matters and occasionally a tea party or picnic. Individual FHWs working in each of the cohorts come for training only when the subjects being covered pertain to work in their cohort. Each FHW therefore comes an average of 2-3 times a month.

A review of the content of all the sessions held shows that the teaching-learning activities were broadly divided as follows:

Knowledge and understanding of general principles	42%
Skills to carry out specific programs	42%
Skills to plan and administer work of sub center	16%

The training of the FHW for RHRC specific job requirements then takes almost 60% of available teaching time and 40% is available for general background knowledge.

Evaluation of the training has thus far been informal. Both FHWs and the senior staff are convinced that great advances have been made.

F. Quality Control as part of Continuing Education

In addition to the quality control measures outlined in last year's progress report (page 8) we have trained one LHV to serve specificially as "spot checket". Repeatability tests had been performed previously on a fairly regular basis by all supervisory personnel and especially the PHNs. At present an experienced FHW systematically and regularly checks the reproducibility of the longitudinal data in every village of the NUT project once every 3 weeks. In visiting a village sub center morbidity, anthropometry and fertility checks are done. For each village the spot checker arranges all the morbidity and anthropometry forms completed within the last 24 hours and the fertility forms completed within the last 7 days in the order of their house numbers. Then, with the help of a table of random numbers she selects 4 of each and redoes the survey by personally visiting each house.

V. Publications

1. 1. Scrimshaw, N.S., C.E.Taylor and J.E.Gordon: Interactions of Nutritions and Infection. WHO Monograph Series No. 57(Geneva: WHO, 1968)

2. Neumann, C.G., H. Shanker and I.S.Uberoi: "Nutritional and Anthropometric Profile of Young Rural Punjabi Children". Ind.J.Med.Res. 57:1122-1142, 1969.

3. Uberoi, I.S., C.DeSweemer, H.Shanker, K.Sharma, F.Masih and N.Masih: "Anemia in Punjabi Children Under Three years". Presented at Annual Session of Nutrition Society of India, Hyderabad, October,1969.

4. DeSweemer, C., I.S.Uberoi, D.N.Kakar, S.Takulia, K.Sharma, N.I.Masih, S.Vohra and C.E.Taylor: "Methdology of Growth Surveillance in Children under five years". Presented at Nutrition Seminar M.S.University of Baroda, February,1970.

5. DeSweemer, C., K.S Takulia, I.S.Uberoi, D N.Kakar, K.Sharma, N.Masih and C.E.Taylor: "The Challenge of Interaction of Nutrition and Infection". Presented at Nutrition Seminar, M.S.University of Baroda, February 1970.

VI Aims for the Future

Although this section reflects some of the information already presented and effort is made here to summarise our operational work plan.

Aim 1: To analyze data obtained in field research between 1968-71 and report findings.

Aim 2 To continue data collection in established field programs so as to get sufficient longitudinal data to provide more statistical valicity and better comparisons.

Aim 3 To conduct more complete investigations on the effects of immunizations on the growth and development of children.

Aim 4 To initiate studies with a view to developing locally acceptable weaning diets with improved nutritional composition.

Aim 5 To develop a child care service program which can be generally implemented.

Aim 6 To introduce more refined and sensitive biochemical analyses for a) the evaluation of the nutritional status of the children b) measuring the effects of our services on the nutritional status of children in different groups of experimental villages.

VII Significance of this Research:

From the scientific point of view, this research should contribute to basic understanding of the interactions of nutrition and infection. First, even basic descriptive information of these interactions is greatly needed. Then because we are doing a longitudinal prospective study, we should be able to get quantitative information on the dynamics of these complex processes both as they occur in individuals and in village communities. The comprehensive nature of our data gathering will permit a broad based epidemiological analysis. Basic research findings relating to specific clinical conditions both nutritional and infections are already coming out of the study. Most important now seems to be the evidence relating to the effect of immunization on the eright of malnourished children.

From the point of view of practical program development, we are also gathering significant information. In order to gather our research information we have had to develop appropriate service packages adapted to village conditions and to have all the work carried out by auxiliaries. We have shown that it is possible to run an effective nutritional supplement program for 0-3 year olds not by trying to supplement all children but by concentrating on those who need the extra food. This avoids the chronic problem of substitution for food that they would have received at home. A monthly weighing routine both provides data and serves to provide screening for nutritional care. Similarly, the auxiliaries are caring for more than 90% of all illness in these children. They are under close supervision and we have learned a great deal about what is needed for good referral and good supervision. These practical findings are already attracting considerable attention among Indian and international health officials.

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TABLE 1

APPENDIX A

Starting dates for cross-sectional surveys in eleven Punjab villages.

Village	Census	Socio-Economic Survey
Mansuran	March 1969	July 1968
Rattan	March 1968	October 1968
Kaind	April 1968	July 1968
Saya	May 1968	October 1968
Bool	September 1968	September 1968
Rurka	May 1968	August 1968
Gurm	May 1968	July-November 1968
Tugal	May 1968	October-December 1968
Rattowal	May-June 1968	October-December 1968
Ghuman	March-April 1970	March-May 1970
Jand	April-May 1970	April 1970

Experimental Design of Nutrition Study

	Village	Total Pop.	Children 0-3 yrs	
Group A (Child Care Alone)	Rattowal	1002	89	
	Tugal	959	78	167
Group B (Nutrition Suppl alone)	Rurka	1307	106	
	Gurm	1282	98	
	Kaind	578	37	
	Bool	532	49	290
Group C (Child Care + Nut.Suppl)	Rattan	621	44	
	Mansuran	2012	168	
	Saya	1510	113	325
Group D (Control)	Ghuman	data not yet analyzed.		
	Jand			

TABLE 4

Starting dates for medical service in eleven Punjab villages

Village	Medical Services	Nutrition
Mansuran	Sept 1968	Feb 1969
Rattan	Sept 1968	Feb 1969
Kaind	-	Oct 1969
Saya	Sept 1969	Oct 1969
Bool	-	Feb 1970
Rurka	-	Sept 1968
Gurm	-	Feb 1970
Tugal	Oct 1969	-
Rattowal	Oct 1969	-
Ghuman	-	-
Jand	-	-

Table 2

Starting dates for Longitudinal Surveys in 11 Punjab Villages.

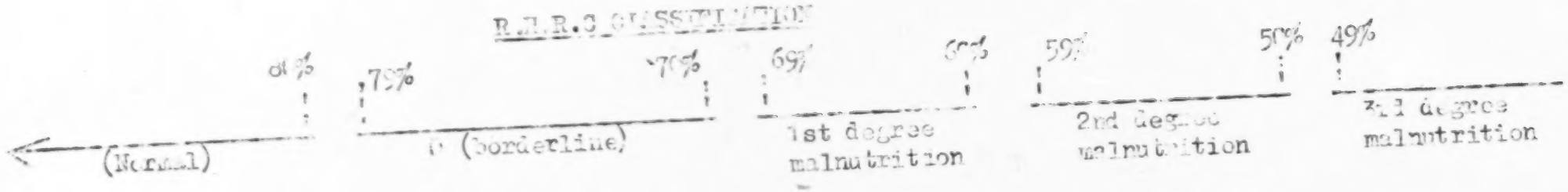
Village	Morbidity	Anthropometry	Fertility	Vital Statistics
Rattowal	Sept. 1968	Nov. 1968	Oct. 1969	Jan. 1969
Tugal	Sept. 1968	Nov. 1968	Oct. 1969	Jan. 1969
Rurka	Sept/Oct 1968 (then Jan. 69)	Oct. 1968	Oct. 1969	Jan. 1969
Gurm	Jan. 1969	Oct. 1968	Oct. 1969	Jan. 1969
Kaind	Sept. 1968	Nov. 1968	Oct. 1969	Jan. 1969
Bool	Sept. 1968	Oct. 1968	Oct. 1969	Jan. 1969
Rattan	Sept. 1968	Oct. 1968	Oct. 1969	Jan. 1969
Mansuran	Sept. 1968	Oct. 1968	Oct. 1969	Jan. 1969
Saya	Sept. 1968	Oct. 1968	Oct. 1969	Jan. 1969
Ghuman	Oct. 1969	Oct. 1969	Oct. 1969	Mar. 1969
Jand	Jan. 1970	Jan. 1970	Jan. 1970	Mar. 1969

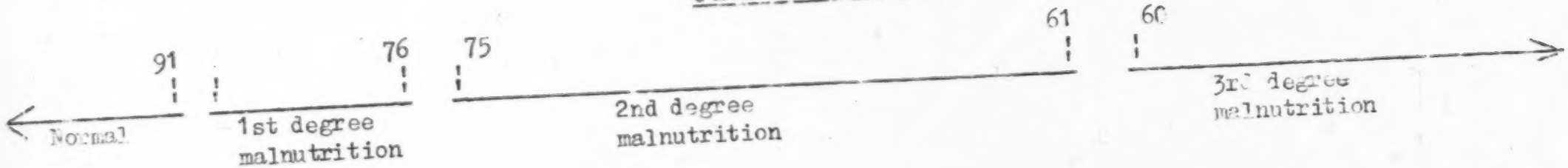
Table 3

Starting Dates of Longitudinal Dietary Survey in Seven Punjab Villages.

Village	Dietary Survey Started
Gurm	Oct. 1969
Mansuran	May 1969
Rattan	Sept. 1969
Saya	Oct. 1969
Kaind	Oct. 1969
Bool	Feb. 1970
Rurka	May 1969

NUTRITIONAL STATUS BY PERCENTAGE WEIGHT FOR AGE.





R.H.R.C. CLASSIFICATION CATERS FOR A POPULATION WHERE 50% ARE BELOW 80% OF PERCENTAGE WEIGHT FOR AGE.

FOOD FOR INFANTS AND PRESCHOOL CHILDREN FROM LOCALLY AVAILABLE RAW MATERIAL

APPENDIX C

We plan to try out new recipes with foodstuffs available either free of cost or at nominal cost from the villages. The available foodstuffs included wheat, jaggery, maize, buttermilk, pulses and leafy vegetables. So far only one dish based mainly on dalia with 2 different compositions has been successfully tried out. Preparations using maize and leafy vegetables are more difficult to adapt from weaning diets. In these preparations, it has been impossible thus far, to supply children with sufficient protein without using milk.

The advantages of the new recipe over the ones which have been used in the feeding centers are:

1. It includes a pulse as well as cereal thus a major part of the expensive milk powder in the present recipe can be replaced, helping keep the cost low.

2. A combination of cereal + pulse + milk supplies a better amino-acid composition than the cereal + milk combination alone.

3. Steeping in water and roasting gives a malty flavour which seems to be generally liked by children. This receipe was tried in the Saya feeding Center on about 30 children. The children reported that they liked the new preparation better than the present dalia preparation.

4. The process of steeping and roating also increases a) the vitamin content (vitamin c, riboflavin and niacin) and : b) the digestibility of proteins and availability of phosphorous.

Method of preparation:

Whole wheat and bengal gram dal are soaked spparately in water for about 3-4 hours (use just enough water to cover the top layer of wheat so that all the water is completely absorbed, after 4 hours). Dry them separately in the shade and then roast till golden brown in colour. Grind bengal gram dal into fine owder and wheat into a course texture (dalia). Store them separately.

Prepare dalia using the following composition with the usual procedure.

Recipe No. 1

Dalia	Amount(g)	Calories	Protein(g)
Wheat	20	70	2.4
Dal	5	18	1.1
Milk Powder	5	18	1.9
Oil	5	45	-
Jaggery	20	80	-
Water	150 or more	-	-
Total. Approx 1 katori		231	5.4

Recipe No.2

Wheat	20	70	2.4
Dal	10	36	2.2
Oil	5	45	-
Jaggery	20	80	-
Milk	30 ml	39	1.4
Water	150 or more	-	-
Total. Approx one katori		270	6.0

Each formula, if given twice daily, provides approx. 450 gm of calories and 11 gms of protein fulfilling approx. 1/3rd of the daily requirements of a year old child.

APPENDIX D

CHILD CARE MANUAL

(To be submitted at a later date).

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